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THE GENUS ANAGALLIS IN TROPICAL AND SOUTH AFRICA.

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In connection with the preparation of the account of the family *Primulaceae* for the " Flora of Tropical East Africa " it was found necessary to revise fully the genus *Anagallis*. Previous work on this genus included two major recent contributions. Knuth[1], in 1905, dealt with the whole genus but his monograph is mainly a compilation, and as such, includes many previous authors' errors. Furthermore, he saw very few specimens ; whereas he cites only about thirty specimens from Africa, I have examined over two hundred and fifty. Although a complete revision has been necessary, Knuth's monograph was not unhelpful in that it provided a basis from which to begin. Eighteen years later Thore C. E. Fries[2] published a highly critical account of the East African high-mountain species. Even then the number of specimens which had been collected in this area was inadequate for such detailed work, and, also, Fries' narrow view concerning species in general led him to create far too many taxa. I propose the reduction of the fifteen species he recognised to four.

The following account deals with the genus as it occurs over the whole of tropical and south Africa. In its preparation, however, I have examined in addition, at least briefly, all of the species that occur outside that area, and having done so feel justified in proposing a new classification for the genus as a whole. Knuth divides the genus into five sections, some of them based on somewhat arbitrary characters, and he maintains the genus *Centunculus* as distinct. I propose to divide the genus into three subgenera and unite *Centunculus* with one of these.

A list of subgenera, sections, species and infraspecific categories recognised appears below. The African species, all dealt with fully, are numbered and in heavy type ; the species not occurring in Africa are italicised and unnumbered.

[1] R. Knuth in Pax et Knuth in Engler, Das Pflanzenreich, Primulaceae, 321–336 (1905), subsequently cited as Knuth, Pflanzenr.

[2] Thore C. E. Fries, Die Anagallis-Arten der afrikanischen Hochgebirge, in Not. Bot. Gart. Berl. **8** : 321–339 (1923), subsequently cited as Fries, Anag. afr.

ANAGALLIS L.

Subgenus 1. ANAGALLIS

1. **A. arvensis** L.
   ssp. **arvensis**
   ssp. *femina* (Mill.) Schinz et Thellung
   A. platyphylla Baudo
   A. parviflora Hoffmg. et Link
   A. monellii L.

Subgenus 2. JIRASEKIA (Schmidt) P. Tayl. stat. nov.

Section 1. Jirasekia

2. **A. schliebenii** Knuth et Mildbr.

3. **A. huttonii** Harv.
   A. peploides Bak.
   A. nummulariifolia Bak.
   A. crassifolia Thore
   A. tenella L.
   A. filiformis Cham. et Schlecht.
   A. alternifolia Cav.

Section 2. Thorefriesia P. Tayl. sect. nov.

4. **A. serpens** Hochst. ex DC.
   ssp. α **serpens**
   ssp. β **meyeri-johannis** (Engl.) P. Tayl. stat. nov.

5. **A. angustiloba** (Engl.) Engl.

6. **A. hexamera** P. Tayl. sp. nov.

Subgenus 3. CENTUNCULUS (L.) P. Tayl. stat. nov.

7. **A. kochii** H. Hess

8. **A. filifolia** Engl. ex Gilg

9. **A. elegantula** P. Tayl. nom. nov.

10. **A. acuminata** Welw. ex Schinz

11. **A. rhodesiaca** R. E. Fries

12. **A. tenuicaulis** Bak.

13. **A. pumila** Sw.
    var. α **pumila**
    var. β **barbata** P. Tayl. var. nov.
    var. γ **djalonis** (A. Chev.) P. Tayl. stat. nov.

14. **A. minima** (L.) Krause
    A. rubricaulis Bojer ex Duby

Subgenus 1, *Anagallis*, is restricted to *A. arvensis* and its close relatives and coincides with Knuth's section *Euanagallis*. It is perhaps less closely related to the other two than they are to each other. As *A. arvensis* only occurs in tropical and south Africa as an introduced weed of cultivation, being primarily a plant of European–Mediterranean distribution, I have not studied it or its relatives in great detail. *A. platyphylla* Baudo seems to be distinct from *A. arvensis*, differing mainly in its greater size. It has however been treated by some authors as a subspecies or a variety of that species. *A. parviflora* Hoffmg. et Link seems to be rather less probably specifically distinct from *A. arvensis*, differing again mainly in size, being very much smaller in all its parts. *A. monellii* L. (*A. linifolia* L.) is a perennial, all of the above being annuals. Stapf, (in Curt. Bot. Mag. **152,** t. 9118 (1926)) recognises *A. collina* as a species distinct from the true *A. monellii* but Knuth treats it as one of the 5 varieties into which he divides *A. monellii* (he uses the name *linifolia* for the aggregate species quite wrongly). Lack of time and a preoccupation with the tropical African flora prevent me from going any more deeply into the respective ranks of the taxa in this subgenus, which as native plants are more or less restricted to the Mediterranean region.

Subgenus 2, *Jirasekia*, comprises the European-Mediterranean *A. tenella* L. and its close relatives. It includes 3 of Knuth's sections—*Jirasekia*, *Euparea* and *Crassifoliae*. The group of species restricted to the high mountains of eastern Africa are, I feel, sufficiently distinct in a fundamental character of floral structure to merit the division of this subgenus into two sections. The typical section contains, in addition to *A. tenella*, a number of species mostly very similar in appearance but occurring in widely separated parts of the world. Two are confined to Africa ; *A. schliebenii*, which is known only from S. Tanganyika, and *A. huttonii* from the eastern part of the Union of S. Africa. *A. filiformis* Cham. et Schlecht. is confined to the eastern side of S. America, from S. Brazil to the extreme south, and is very closely related indeed to *A. tenella* and quite possibly a close study may reveal that it is in fact conspecific. If this is so *A. tenella* would have a remarkably discontinuous distribution. Good, however (The Geography of the Flowering Plants 208 (1953)) gives several examples of identical and similar distributions. *A. alternifolia* Cav. is also confined to S. America from Tierra del Fuego northwards up the western side of the sub-continent. It is very variable and Knuth recognises five varieties. The variation is however probably due to the wide vertical range of the species, from sea level to high altitudes in the Andes. *A. peploides* Bak. and *A. nummulariifolia* Bak. are closely related to each other and to *A. huttonii* and both are confined to Madagascar. *A. crassifolia* Thore is confined to the western Mediterranean region and differs from the other species in the section in having very small, shortly pedicellate flowers. The second section of the subgenus *Jirasekia* does not exactly coincide with any of Knuth's sections. I have named it *Thorefriesia* in honour of Thore C. E. Fries, whose classification of this group has apparently received such unkind treatment in the present account. It comprises 3 species all of which are confined to the mountains of eastern Africa.

Subgenus 3, *Centunculus*, comprises the widespread *A. minima* (*Centunculus minimus*) and the whole of Knuth's section *Micropyxis*, that is, the

Table 1. *Distribution of the species of Anagallis throughout the world.*

	Europe	Mediterranean Region	India	Malay Islands	Australia	Tropical Africa	S. Africa	Madagascar	N. America	Central America	West Indies	E. Trop. S. America	W. Trop. S. America	Temp. S. America
arvensis	×	×	W		W	W	W		W	W	W	W	W	W
parviflora		×												
platyphylla		×												
monellii		×												
crassifolia		×												
tenella } ?	×	×												
filiformis }												×		×
alternifolia													×	×
peploides								×						
nummulariifolia								×						
huttonii							×							
schliebenii						×								
serpens						×								
angustiloba						×								
hexamera						×								
kochii						×								
filifolia						×								
elegantula						×								
acuminata						×								
rhodesiaca						×								
tenuicaulis						×	×	×						
rubricaulis								×						
pumila			×	×	×	×	×		*	×	×	×	×	
minima	×	×	×			×			×	×		×	×	×

× Occurs as a native plant. W as an introduced weed. * Peninsular Florida only.

Table 2. Distribution of the species of Anagallis in Tropical and S. Africa.

	arvensis	schliebenii	huttonii	serpens ssp. serpens	serpens ssp. meyeri-johannis	angustiloba	hexamera	kochii	filifolia	elegantula	acuminata	rhodesiaca	tenuicaulis	pumila var. pumila	pumila var. barbata	pumila var. djalonis	minima
French Guinea ...														×		×	
French Sudan ...															×		
Nigeria														×	×		
Belgian Congo ...						×				×					×		
A.E. Sudan... ...				×											×		
Somaliland ...	w																
Ethiopia	w			×			×										×
Eritrea	w																
Uganda					×	×							×		×		
Kenya	w				×	×	×						×	×	×	×	
Tanganyika ...	w	×			×	×							?	×	×	×	
Zanzibar															×		
Portuguese East Africa															×		
S. Rhodesia ...				×							×		×	×	×		
N. Rhodesia ...										×	×	×	×		×	×	
Angola								×	×	×	×		×	×	×	×	
S.W. Africa ...														×			
Transvaal ...	w		×											×			
Basutoland			×														
Griqualand E. ...	w		×														
Natal			×										×				
Cape Province ...	w		×														

× Occurs as native plant. w as an introduced weed.

pantropical *A. pumila* (*Centunculus pentandrus*, *Micropyxis pumila* etc.) and the group of closely related species mainly confined to southern tropical Africa and Madagascar. Only one species included in this subgenus does not occur in tropical Africa, that is the Madagascar *A. rubricaulis* Boj. ex Duby. It is closely related to *A. pumila*, differing in its longer ascending pedicels and narrower leaves. Knuth wrongly cites three specimens referable to this species under *A. tenuicaulis* (*Baron* 594, 970 and 5252). In uniting the genera *Centunculus* and *Anagallis* I am fully aware that I am making a break with a long standing tradition amongst European botanists. The two genera are keyed out by J. D. Hooker (in Benth. et Hook. f., Gen. Pl. **2** : 630 (1876)) as follows :—

ANAGALLIS. *Corolla calycem excedens*, 5 *partita, tubo brevissimo. Stamina basi corollae affixa. Herba, foliis oppositis alternisque, floribus axillaribus solitariis.*

CENTUNCULUS. *Corolla calyce breviore*, 4–5 *loba, tubo lobis breviore. Stamina fauci corollae affixa. Herbae pusillae foliis alternis oppositisque, floribus minimis axillaribus solitariis.*

He includes in *Centunculus* " *species 2 v. 3* ", one of these presumably, (from the references cited), *Centunculus pentandrus* (*A. pumila*), the corolla of which always at least equals or usually exceeds the calyx, thus invalidating the first of his key characters. My interpretation of the floral structure is that the stamens are always inserted at the base of the corolla tube, being, however, connate and adnate to it for a certain length at the base. In *Centunculus minimus* the corolla is very short and about half of the total length of the stamens is connate and adnate. In *A. pumila* (with the exception of var. *djalonis*) the corolla is longer and rather less than a quarter of the total length of the stamens is connate and adnate, as in the whole of the rest of the subgenus and genus. Therefore as the amount of adnation is merely a matter of degree and varies within a single species, I do not consider that " *Stamina basi corollae affixa* " and " *Stamina fauci corollae affixa* " are in this case valid characters on which to distinguish genera. *A. pumila* is undoubtedly congeneric with *A. tenuicaulis* which in turn is mainly distinguished from the other members of the subgenus by small but constant differences of habit and in the vegetative parts. The subgenus as a whole differs from the subgenus *Jirasekia* in the terminal position of its inflorescence and its erect habit, and from the subgenus *Anagallis* in its usually small pale flowers and alternate leaves.

The two species discussed above (*A. minima* and *A. pumila*) apart from the confusion as to genera, have, due to their comparatively wide distributions (which overlap), been the cause of confusion in other respects. I have therefore, in an attempt to clear up this confusion, given what I hope is the fully synonymy of both species and in addition have cited certain specimens from the non-African parts of their ranges.

The distribution of the species of the genus as a whole throughout the world is summarised in *Table* 1. More detailed distribution of the African species is indicated in *Table* 2. It can be seen from the latter that the greatest concentrations of species are in (1) the highlands of East Africa, (2) the Rhodesia-Angola region of southern tropical Africa. The habitats in which the species occur within these two areas are somewhat

different. In the former area it is in bogs and by streamsides on high mountains at altitudes mainly between 2000 and 4000 m. that *Anagallis* species occur. In the latter area they are found in marshes and seasonally flooded ground at the " normal " altitudes of that part of Africa, i.e., about 1000–1500 m.

The specimens cited have all been examined and are deposited in the Kew Herbarium unless it is stated otherwise. I have used the standard abbreviations for designating the other herbaria from which I have seen specimens (see Lanjouw & Stafleu, Index Herbariorum (1954)) and where such specimens are also represented at Kew I have so indicated. A convention proposed and used by Gillett (see Kew Bull. 1952 : 367 (1952)) has been used in the descriptions of new taxa. This enables information derived from specimens other than the actual type to be included in the description enclosed in square brackets.

My grateful thanks are due to the authorities at the Brussels, Paris, Stockholm, Uppsala and East African Herbaria for the loan of specimens, including types ; to Dr. O. Hedberg of Uppsala for the loan of very useful material collected by himself in the East African mountains ; to Dr. H. Wild of Salisbury and Herr Hans Hess of Zurich for the presentation to Kew of important and useful specimens ; and lastly to many of my colleagues at Kew for assistance at all stages of the work, especially Messrs. J. P. M. Brenan, A. A. Bullock, E. Milne-Redhead, N. Y. Sandwith, and Dr. W. B. Turrill.

Key to the Subgenera, Sections and Species

Corolla typically bright blue or red, lobes entire or denticulate at the apex, usually fringed with glands ; erect or ascending plants of dry places, branching from the base, not rooting at the nodes ; leaves always opposite or verticillate . . . . subgen. 1. Anagallis
1. *arvensis* ssp. *arvensis*

Corolla pink or white, lobes entire, obtuse or acuminate at the apex, not fringed with glands ; erect to prostrate plants of wet or damp places ; leaves opposite or alternate.

Prostrate plants rooting at the nodes, or rarely erect plants ; ovary glabrous ; inflorescence lateral, flowering shoots always leafy at the apex ; corolla lobes not acuminate . subgen. 2. Jirasekia

Filaments connate above the point of attachment to the corolla ; prostrate or erect plants . . . . . sect. 1. Jirasekia

Erect plant ; leaves alternate, filiform to linear, corolla lobes 6–7 mm. long ; filaments bearded below . 2. *schliebenii*

Prostrate or rarely ascending plant ; leaves opposite, obovate to orbicular ; corolla lobes about 6 mm. long ; filaments bearded below . . . . . 3. *huttonii*

Filaments not connate above the point of attachment to the corolla ; prostrate plants . . . . . sect. 2. Thorefriesia

Plants usually closely adpressed to the soil ; stems rooting at the nodes throughout their length ; leaves usually widest at or above the middle ; pedicels fleshy ; filaments glabrous 4. *serpens*

Leaves opposite, obovate to orbicular, 5–20 mm. long, 3–12 mm. broad ; corolla lobes 8–10 mm. long . 4. ssp. α *serpens*

Leaves alternate, oblanceolate to orbicular, usually ± obovate, 4–16 mm. long, 3–10 mm. broad ; corolla lobes 3–13 mm. long . . . . . 4. ssp. β *meyeri-johannis*

Plants not usually closely adpressed to the soil ; stems usually rooting at the lower nodes only ; leaves ovate, always widest below the middle ; pedicels filiform ; filaments bearded or glabrous.

Corolla lobes 4·5–6[8] mm. long ; leaves opposite or alternate, 8–15 mm. long [2·5]4–8 mm. broad ; filaments glabrous ; flowers usually 5-merous, rarely 6-merous . 5. *angustiloba*

Corolla lobes 9–12 mm. long ; leaves opposite or rarely alternate, 12–22 mm. long, 6–10 mm. broad ; filaments bearded below ; flowers usually 6-merous, rarely 5- or up to 8-merous . . . . . 6. *hexamera*

Erect or rarely decumbent, often succulent plants, not normally rooting at the nodes ; ovary usually covered with granular glands ; inflorescence terminal (sometimes also lateral), flowers always present in the axils of apical leaves on flowering shoots ; corolla sub-persistent, lobes often acumimate . subgen. 3. CENTUNCULUS

Flowers pedicellate (sometimes only very shortly so in *A. pumila*), usually 5-merous, rarely 4- or 6-merous, corolla equal to or exceeding the calyx.

Leaves usually more than 6 times, never less than 3 times as long as broad, filiform to oblanceolate.

Leaves linear-filiform to capillary up to at least 20 mm. long ; corolla lobes obtuse or rounded at the apex, pink.

Aquatic plant with submerged capillary leaves 20–50 mm. long ; pedicels up to 50 mm. long ; calyx lobes obtuse ; corolla lobes 5–7 mm. long . . . . . 7. *kochii*

Terrestrial plant with linear-filiform leaves up to 20 mm. long ; pedicels up to 15 mm. long ; calyx lobes acute ; corolla lobes about 5 mm. long . . . . 8. *filifolia*

Leaves linear to oblanceolate, not more than 10 mm. long ; corolla lobes acuminate, usually white.

Plant branched [4] 15–25 cm. high ; leaves linear-lanceolate to oblanceolate, acute, 5–10 mm. long ; corolla lobes 4–4·5 mm. long . . . . . 9. *elegantula*

Plant simple, 4–6[10] cm. high ; leaves linear-lanceolate, 2–7 mm. long ; corolla lobes 2–3 mm. long.

Filaments bearded below . . . . . 10. *acuminata*

Filaments glabrous . . . . . 11. *rhodesiaca*

Leaves less than twice as long as broad, more or less ovate :

Plant usually decumbent, stems distinctly winged, up to 40 cm. long ; corolla lobes 4–5 mm. ; filaments bearded below ; anthers 0·4–0·7 mm. long . . . . . 12. *tenuicaulis*

Plant usually erect ; stems subterete or angled, scarcely winged, up to 25 cm. high ; corolla lobes under 4 mm. long ; anthers less than 0·25 mm. long . 13. *pumila*

Filaments adnate to the corolla for $\frac{1}{8}$–$\frac{1}{4}$ of their total length, free part filiform.

Filaments glabrous ; corolla lobes 1·7–3 mm. long 13. var. α *pumila*

Filaments bearded below ; corolla lobes 2·5–4 mm. long 13. var. β *barbata*

Filaments adnate to the corolla for $\frac{1}{3}$–$\frac{1}{2}$ of their total length, free part dilated and flattened ; corolla lobes 1·7–1·9 mm. long . . . . . 13. var. γ *djalonis*

Flowers sessile, 4- or 5-merous ; corolla usually shorter than the calyx ; filaments adnate to the corolla for $\frac{1}{2}$ or more of their total length . . . . . 14. *minima*

Subgenus 1. ANAGALLIS

Anagallis sect. *Euanagallis* Hook. f. in Benth. et Hook f., Gen. Pl. **2** : 637 (1876) ; Knuth, Pflanzenr. 322 (1905).

1. Anagallis arvensis L., Sp. Pl. 148 (1753) ; Vatke in Linnaea **40** : 205 (1876) ; Oliv., Fl. Trop. Afr. **3** : 490 (1877) ; Knuth, Pflanzenr. 323 (1905) ; Harv. in Dyer, Fl. Cap. **4** (**1**) : 429 (1909).

ssp. arvensis

Anagallis phoenicea Scop., Fl. Carn. ed. 2, **1** : 139 (1772).

[*Anagallis capensis* (non L.) — E. Meyer in Drège, Zwei Pfl. Documente, 98 (1843)].

Anagallis arvensis L. var. *phoenicea* (Scop.) Gren. et Godr., Fl. France **2** : 648 (1852) ; Knuth, Pflanzenr. 323 (1905).

[*Anagallis arvensis* L. var. *caerulea* (non (Schreb.) Gren. et Godr.) — Knuth, Pflanzenr. 323 (1905) partim ; Harv. in Dyer, Fl. Cap. **4** (**1**) : 429 (1909)].

Anagallis arvensis L. ssp. *phoenicea* (Scop.) Schinz et Keller, Fl. Schweiz. ed. 3, **1** : 419 (1909) ; Hegi, Ill. Fl. Mitt.-Eur. **5** (**3**) : 1869 (1927) ; Marsden-Jones & Weiss in Proc. Linn. Soc. **150** : 146 (1937).

Anglo-Egyptian Sudan. Red Sea Hills, 1700 m., Apr. 1953, *J. K. Jackson* 2878 ; ibid., Erkowit, March 1953, *J. K. Jackson* 2737 ; ibid., *Moham. Eff. Ismail* A3461, A3516 & A3533 ; ibid., *Lady Maffey* 11. Karora Hills, Feb. 1923, *Crowfoot* s.n.

Somaliland. Sugli, 1425 m., Nov. 1929, *Collenette* 232. Shimba Beris, 2025 m., Dec. 1929, *Collenette* 350. Wagga Mountain, 1897, *Lort Phillips* s.n. (K, BM).

Ethiopia. Chiré, 1862, *Quartin Dillon & Petit* s.n. Semen, Aug. 1840, *Quartin Dillon & Petit* s.n. Addis Ababa, 2250 m., May 1953, *Mooney* 4759 ; ibid., *Dobinson* 13 (BM). Between Harar and Ababa, Sept. 1901. *Wellby* s.n. Geldid, 2430 m., March 1953, *Gillett* 5379. Mega, 1840 m., Nov., 1952, *Gillett* 14421. Amogai, 2040 m., Sept. 1862, *Schimper* 244 (BM) ; without locality, 1842, *Schimper* 1421 (BM) ; 1844, *Schimper* 1872 (K, BM) ; *Pearce* s.n. (BM).

Eritrea. Asmara, 2300 m., Sept. 1902, *Pappi* 187 (K, BM).

Kenya. Northern Frontier Province ; Furroli, 1860 m., Sept. 1952, *Gillett* 13925. Mt. Elgon, 2280 m., June 1950, *Tweedie* 847 ; ibid., Endebess, 2280 m., *Webster* AH9962 (EA). Uasin Gishu District ; Eldoret, 2100 m., Aug. 1948, *Bogdan* 1900 ; ibid., July 1951, *G. R. Williams* 268 ; Moiben, 1932, *Broadhurst Hill* 232 (K, EA). Kiambu District ; Muguga, Aug. 1952, *Verdcourt* 715. Nakuru District ; Njoro, Sept. 1915, *Dowson* 271. Mt. Kenya, 1800 m., Jan. 1922, *R. E. & Th. C. E. Fries* 1035 ; ibid., Nanyuki, 2010 m., *Moreau* 83 (EA). Nairobi 1650 m., 1924, *Macdonald* 772. Machakos District ; Kiu, 1350 m., March 1930, *Napier* 38 (K, EA).

Tanganyika. Masai District ; Ngorongoro, 1500 m., Apr. 1941, *Bally* 2323 ; Monduli, Gt. Ardai Plain, 1380 m., July 1943, *Greenway* 6757 (K, EA) ; ibid., June 1944, *Fuggles Couchman* 91 (EA). Mbulu District ; June 1942, *Moreau* 9082 (EA).

Transvaal. Lydenburg, Dec. 1885, *Wilms* 1244.

Griqualand E. Shawburg, 540 m., June (comm. 1885) *Baur* 199.

Cape Province. The following are additional to those cited in Flora Capensis :— Tulbagh, 160 m., Sept. 1892, *Schlechter* 1390. Humansdorp, Nov. 1921, *Phillips* 3428 ; ibid., Feb. 1910, *Fourcade* 578 ; Clarkson, 1926, *Thode* 955. Port Elizabeth, Oct. 1933, *Long* 1101 ; ibid., Sept. 1947, *Rodin* 1258.

Habitat : a weed of cultivation introduced from Europe, 1350–2430 m. in tropical Africa, down to sea level in S. Africa. In NE. tropical Africa (Anglo-Egyptian Sudan, Ethiopia and Somaliland) it also occurs in open *Juniperus* forest with the appearance of being native.

The synonymy given above is of course very far from complete. In dividing *A. arvensis* into two subspecies I have followed Marsden-Jones & Weiss (l.c.). Dissection and examination of flowers from all of the tropical and south African material shows it to belong entirely to the subspecies *anagallis* (*phoenicea*). It is of interest that whereas in western Europe generally (including the British Isles) the scarlet flowered form predominates, and in the Mediterranean region and in S. Africa scarlet and blue forms apparently occur in about equal numbers, in tropical Africa, (and apparently in the tropics generally), the blue flowered form is the most frequent. This would seem to indicate that perhaps climatic (especially photoperiodic) as well as genetic factors influence the predominance or otherwise of a particular colour. With the possible exception of the areas indicated (i.e. those nearest to the known native range of the species) *A. arvensis* is always in Africa more or less obviously introduced.

Subgenus 2. JIRASEKIA (Schmidt) P. Tayl. stat. nov.

Euparea Banks et Soland. ex Gaertn., Fruct. **1** : 230 (1788) ; Steud., Nom. ed. 2, **1** : 606 (1840) ; Baudo in Ann. Sc. Nat., Sér. 2, **20** : 345 (1843) excl. *A. exillis* Baudo ; Duby in DC., Prodr. **8** : 68 (1844).

Irasekia S. F. Gray, Nat. Arr. **2** : 299 (1821).

Tirasekia G. Don in Sweet, Hort. Brit. ed. 3, 563 (1839).

Anagallis sect. *Jirasekia* (Schmidt) Hook. f. in Benth. et Hook. f., Gen. Pl. **2** : 637 (1876) ; Knuth, Pflanzenr. 329 (1905).

Anagallis sect. *Euparea* (Banks et Soland ex Gaertn.) Knuth, l.c. 330 (1905).

Anagallis sect. *Crassifoliae* Knuth, l.c. 326 (1905).

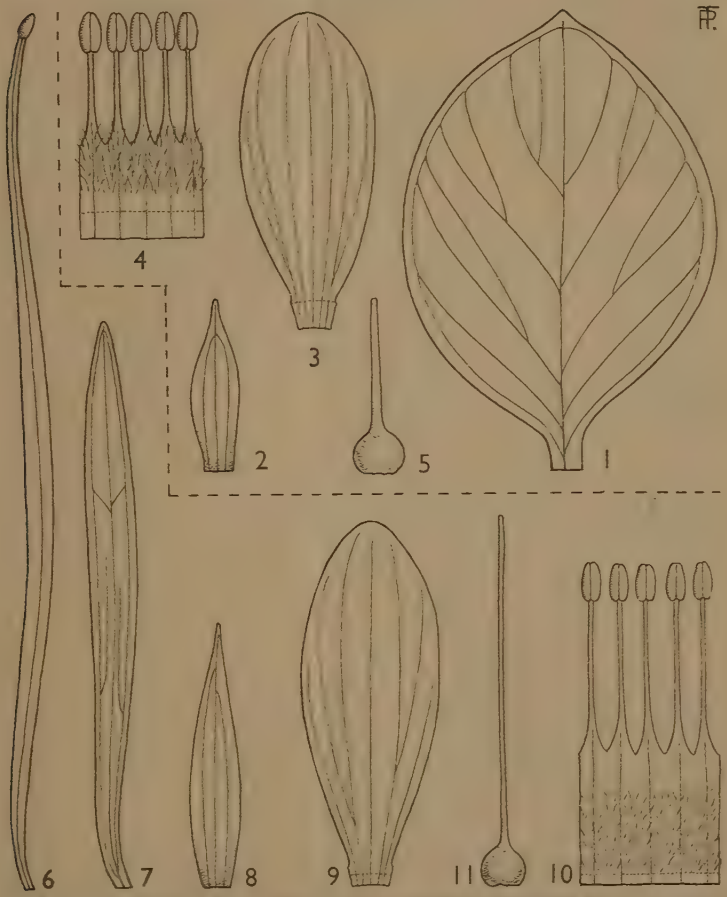

FIG. 1. *Anagallis huttonii* Harv. 1, leaf ; 2, calyx lobe ; 3, corolla lobe ; 4, stamen opened out and seen from outside ; 5, pistil. *Anagallis schliebenii* Knuth et Mildbr.— 6, leaf from lower part of stem with terminal gland ; 7, leaf from upper part of stem ; 8, calyx lobe ; 9, corolla lobe ; 10, stamens opened out and seen from outside ; 11, pistil, all × 8.

Section 1. JIRASEKIA

2. Anagallis schliebenii Knuth et Mildbr. in Not. Bot. Gart. Berl. **11** : 672 (1932).

Tanganyika. Njombe District ; Lupembe, Nov. 1931, *Schlieben* 1420 (B, holotype destroyed, BM, BR isotypes).

Habitat : streambanks and marshes.

Known only from the single gathering cited, this extraordinary little plant is of great interest. It has the erect habit and general appearance of the subgenus *Centunculus* but it is, I think, correctly placed here on the strength of the nature of the inflorescence and the structure of the flowers. The tips of the lower leaves (which may possibly be submerged when the plant is growing) end in a curious pointed glandular swelling, the purpose or function of which I am at a loss to explain. (See Fig. 1, 6–11).

3. Anagallis huttonii Harv. in Proc. Dublin Univ. Zool. & Bot. Ass. **1** : 141 (1859) ; Knuth, Pflanzenr. 330 (1905) ; Harv. in Dyer, Fl. Cap. **4** (**2**) : 429 (1906) et var. *nummularia*.

Transvaal. Vlakfontein, Jan. 1914, *Rogers* 11527. Lydenburg, Dec. 1883, *Wilms* 1243 (K, BM). Belfast, Jan. 1952, *Prosser* 1772. Hautbosh, 1875–80, *Rehmann* 6369 (BM).

Natal. Maritzburg, 750 m., Nov. 1885, *Stainbank* 3570. Alexandria District, Dumisa, 700 m., Dec. 1908, *Rudatis* 575 (K, BM) ; ibid., 600 m., Jan. 1911, *Rudatis* 1295 (K, BM). Bergville District ; Cathedral Peak, 1815 m., Dec. 1950, *Killick* 1231.

Basutoland. Mamalapi District ; 2250 m., Dec. 1948, *Guillarmod* 772.

Griqualand E. Mount Currie, 1950 m., Feb. 1883, *Tyson* 1359. Kokstad, 1200–1500 m., Dec. 1889, *Haygarth* 838 (BM).

Cape Province. Albany Division, Howisons Poort near Grahamstown, *Hutton* s.n. (TCD, holotype not seen, K, isotype). The following are additional to those cited in Flora Capensis :—George Division ; near George, 216 m., March 1893, *Schlechter* 2371 (K, BM). Isolo Division ; Ngadu Mt., Feb. 1910, *Pegler* 1574. Kentani Division ; 360 m., Oct. 1907, *Pegler* 212 (K, BM).

Habitat : marshes, shallow pools and streambanks, 216–2250 m.

The considerable vertical range of this species is probably responsible for its variability in size. Plants from high altitudes in the northern and central parts of its range are much smaller in all of their parts than those from low levels in the southern part of its range. The var. *nummularia* of Harvey is merely an extreme form of the latter type and of no taxonomic significance. (See Fig. 1, 1–5).

Section 2. Thorefriesia. P. Tayl. sect. nov. a sectione *Jirasekia* filamentis supra eorum insertionem vix connatis. Montium excelsorum Africae orientali incolae.

Anagallis sect. *Crassifoliae* Knuth, Pflanzenr. (1905) pro max. parte, excl. *A. crassifolia* Thore, *A. nummulariifolia* Bak., *A. peploides* Bak. et ? *A. kingaensis* Engl. ; Fries, Anag. afr. 329 (1923).

4. Anagallis serpens Hochst. ex DC., Prodr. **8** : 668 (1844) ; Vatke in Linnaea **40** : 205 (1876) ; Knuth, l.c. 326 (1905) ; Fries, l.c. 332 (1923).

ssp. α serpens

Euparea serpens Baudo in Ann. Sc. Nat. **20** : 345 (1843) (nomen).

Lysimachia quartiniana A. Rich., Tent. Fl. Abyss. **2** : 16 (1851) ; Klatt in Abh. Naturw. Vereins Hamburg **4** (**4**) : 27, t. 15 (1866) ; Oliv., Fl. Trop. Afr. **3** : 489 (1877).

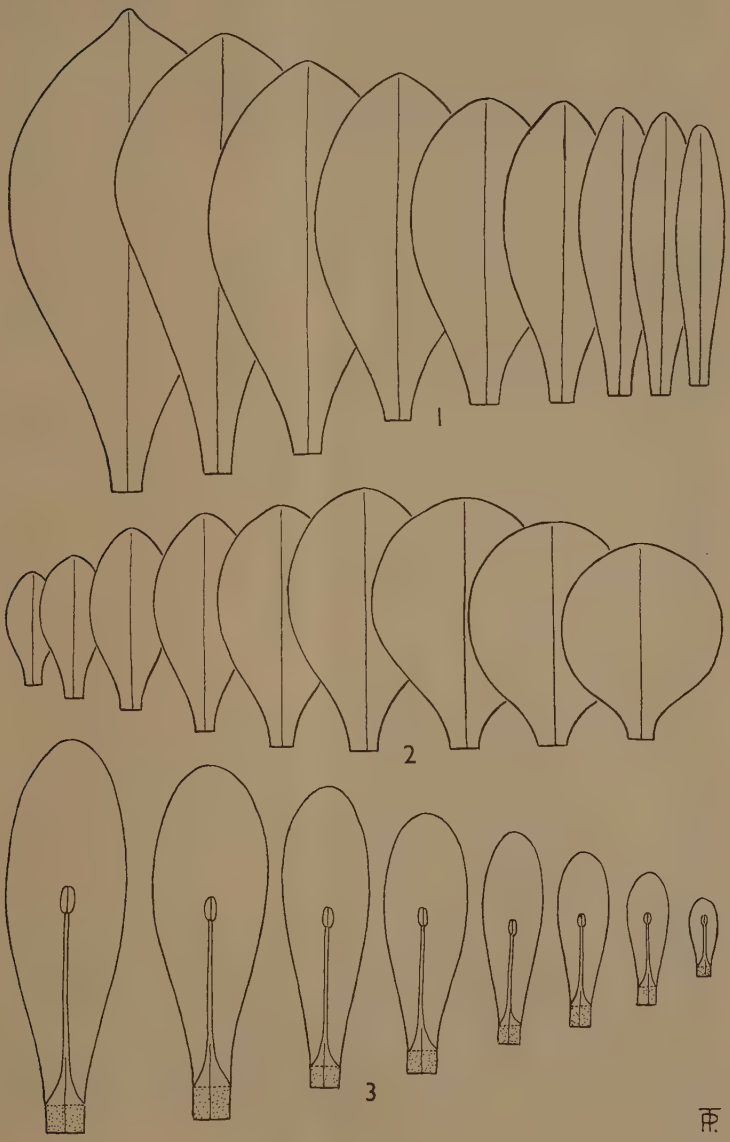

FIG. 2. *Anagallis serpens* Hochst. ex DC., subsp. *meyeri-johannis* (Engl.) P. Tayl.—1, series of leaves showing the transition in shape and length from the large (i.e. long and broad) on the left, to the long narrow types on the right ; 2, series of leaves showing the rest of the range in shape and length, from the small (i.e. short and narrow) on the left and to the short and broad on the right ; 3, series of corolla lobes with attached stamens showing the transition from the largest on the left to the smallest on the right, all × 4.

Anagallis quartiniana (A. Rich.) Engl., Hochgebirgsfl. Trop. Afr. 330 (1892) partim excl. var. *meyeri-johannis* ; Knuth, l.c. 326 (1905) partim excl. spec. *Hoehnel* 83 ; Fries, l.c. 331 (1923).

Ethiopia (N.). Silke, June 1840, *Schimper* 547 (K, BM, isotypes of *A. serpens*). Ouedjerate, 1862, *Quartin Dillon & Petit* s.n. (K, isotype of *Lysimachia quartiniana*). Harar ; Gara Mulata Pass, 3660 m., March 1933, *Gillett* 5366.

Anglo-Egyptian Sudan. Imatong Mts., below Kipia, 2610 m., July 1939, *Myers* 11701.

Southern Rhodesia. Inyanga, 2010 m., *Sturgeon in Southern Rhodesian Govt. Herb.* 15918.

ssp. β meyeri-johannis (Engl.) P. Tayl. stat. nov.

Anagallis quartiniana (A. Rich.) Engl. var. *meyeri-johannis* Engl., Hochgebirgsfl. Trop. Afr. 330 (1892) et in Pflanzenw. Ost. Afr. **C** : 304 (1895).

Anagallis meyeri-johannis (Engl.) Engl. in Bot. Jahrb. **30** : 372 (1902).

Anagallis kilimandscharica Knuth, Pflanzenr. 326 (1905) ; Fries, Anag. afr. 336 (1923).

Anagallis meyeri Schumann ex Knuth, l.c. 328 (1905) pro syn.

Anagallis bella Scott in Kew Bull. 1914 : 336 (1914) ; Fries. l.c. 335 (1923).

Anagallis keniensis Fries, l.c. 333 (1923) et forma *aberdarensis*.

Anagallis granvikii Fries, l.c. 335 (1923).

Anagallis roberti Fries, l.c. 337 (1923).

Anagallis iraruensis Fries, l.c. 337 (1923).

Anagallis aberdarica Fries, l.c. 338 (1923).

Anagallis micrantha Fries, l.c. 338 (1923).

Uganda. Mt. Elgon ; 3150 m., Apr. 1950, *Forbes* 275 ; 4050 m., Jan. 1918, *Dummer* 3352 ; 3120 m., Dec. 1939, *A. S. Thomas* 2688a ; 3600 m., May 1948, *Hedberg* 1042 (UPS) ; 2850 m., Aug. 1934, *Synge* 874 (BM) ; 1920, *Benham* s.n. (BM).

Kenya. Mt. Elgon ; 3060 m., May 1953, *Irwin* 96 ; 3300–4050 m., Nov. 1932, *Tweedie* s.n. ; 3495 m., Dec. 1930, *Lugard* 325a (K, EA) ; *Barney* s.n. ; 2700 m., March 1935, *Thorold* 2743 ; 1920, *Granvik* s.n. (S, holotype of *A. granvikii*) ; 3900 m., May 1948, *Hedberg* 1040 (UPS) ; 3250 m., Feb. 1948, *Hedberg* 143 (UPS) ; 3000 m., March 1948, *Hedberg* 184 (UPS) ; 2300 m., Feb. 1948, *Hedberg* 21 (UPS) ; 4050 m., Feb. 1935, *G. Taylor* 3525 (BM) ; 3960 m., Feb. 1935, *G. Taylor* 3552 (BM) ; 3300 m., Feb. 1932, *Tweedie* 30 (EA).

Aberdare Range ; 2800 m., March 1922, *R. E. & Th. C. E. Fries* 2397 (UPS, holotype, K, isotype of *A. aberdarica*) ; 2590 m., Nov. 1953, *Verdcourt* 1116 (K, EA) ; March 1922, *R. E. & Th. C. E. Fries* 2398 (UPS, holotype, K, isotype of *A. keniensis* forma *aberdarensis*) ; 3000 3600 m., March 1910, *Galpin* 7927 ; 3000 m., Aug. 1915, *Battiscombe* 833 (K, holotype of *A. bella*) ; 3050 m., July 1948, *Hedberg* 1651 (UPS) ; 2900 m., July 1948, *Hedberg* 1513 (UPS) ; 3680 m., July 1948, *Hedberg* 1547 (UPS) ; 2700–3000 m., June 1931, *Dent* 1304 (K, EA) ; 3000–3300 m., Oct. 1939, *Leakey* 1393/28 (EA); July 1939, *Copley* 139 (EA) ; 2800 m., March 1922, *R. E. & Th. C. E. Fries* 2261 (UPS, holotype, K, isotype of *A. roberti*) ; March 1922, *R. E. & Th. C. E. Fries* 2195 (UPS) ; 3050 m., Oct. 1934, *G. Taylor* 1375 (BM) ; 3050 m., Oct. 1934, *G. Taylor* 1392 (BM).

Mau Range ; 2190 m., Jan. 1946, *Bally* 4944.

Marakwet Hills ; 3000 m., June 1935, *Dale* 3436 (K, EA).

Mt. Kenya ; 3150 m., Nov. 1943, *Bally* 3310 (K, EA) ; 3150 m., Sept. 1948, *J. C. Williams* 6395 ; 3450 m., June 1933, *Rogers* 618 ; 2880 m., April 1942, *Maclaughlin* 2878 ; 3000–3300 m., Aug. 1931, *Slade* 33 (K, EA) ; 3300 m., Aug. 1944, *Le Pelley* 3459 ; Jan. 1922, *R. E. & Th. C. E. Fries* 1171 (UPS, holotype, K, isotype of *A. keniensis*) ; 2300 m., Dec. 1921, *R. E. & Th. C. E. Fries* 325 (K, UPS) ; Feb. 1922, *R. E. & Th. C. E. Fries* 1847 (UPS, holotype, K, isotype of *A. iraruensis*) ; 2300 m., Dec. 1921, *R. E. & Th. C. E. Fries* 369 (UPS, holotype, K, isotype of *A. micrantha*) ; 3100 m., Aug. 1948, *Hedberg*

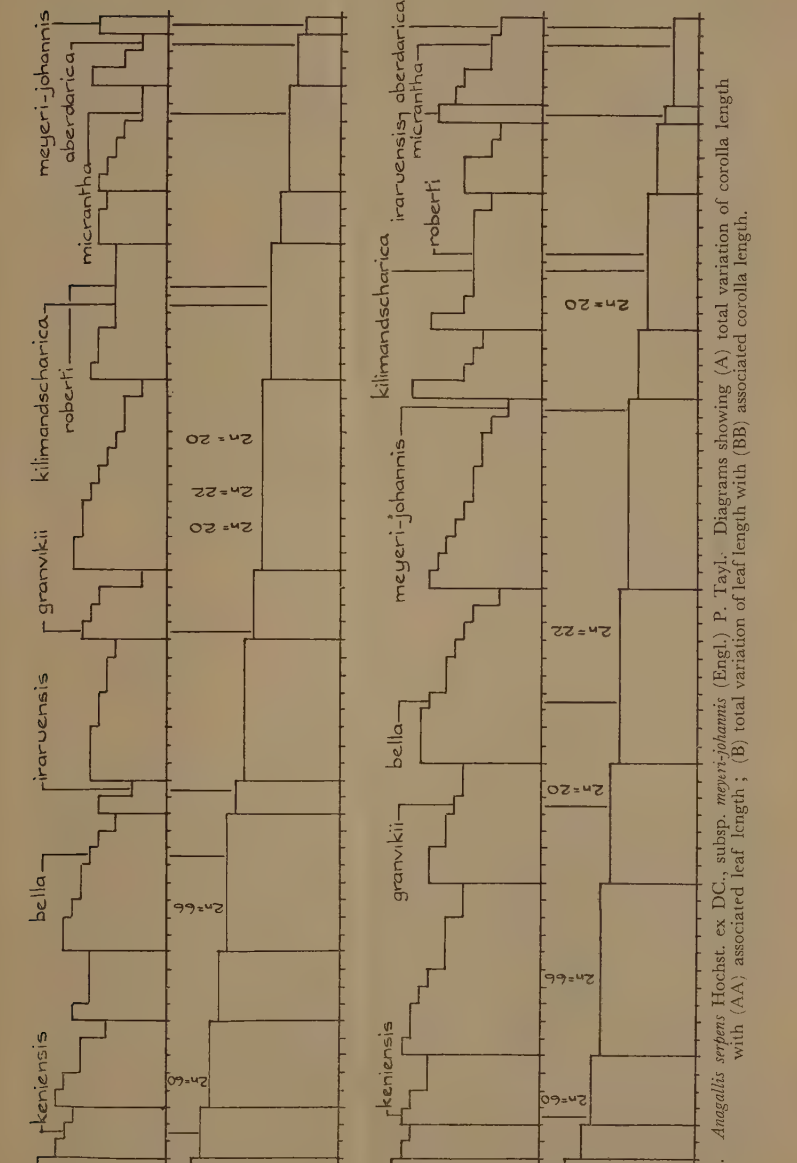

FIG. 3. *Anagallis serpens* Hochst. ex DC., subsp. *meyeri-johannis* (Engl.) P. Tayl. Diagrams showing (A) total variation of corolla length with (AA) associated leaf length; (B) total variation of leaf length with (BB) associated corolla length.

1968 (UPS) ; 3150 m., June 1943, *Moreau* 160 (EA) ; 3300 m., Feb. 1936, *Meinertzhagen* 4439 (EA) ; 3000–3300 m., Dec. 1934, *Gedge* 6605 (EA) ; June 1893, *Gregory* s.n. (BM) ; 3000 m., Aug. 1949, *Schelpe* 2772 (BM) ; 3450 m., May 1935, *Synge* 1788 (BM) ; 3600 m., Feb. 1914, *Orde Browne* s.n. (BM) ; 3000 m., Aug. 1949, *Schelpe* 2687 (BM).

Tanganyika. Kilimanjaro, 4500 m., July 1887, *Meyer* 153 (B, holotype of *A. meyeri-johannis*, destroyed) ; 3000 m., Nov. 1901, *Uhlig* 550 (EA) ; 4500 m., Jan. 1913, *Grote* 5084 (EA) ; 4200 m., Feb. 1928, *Haarer* 1146 (K, EA) ; 3720 m., Feb. 1934, *Greenway* 3741 (K, EA) ; 1920 m., Nov. 1932, *Rogers* 93 (K, EA, BM) ; 3750 m., June 1948, *Hedberg* 1244 (UPS) ; 3100 m., June 1948, *Hedberg* 1329 (UPS) ; 3300 m., March 1920, *Swynnerton* 1349 (K, BM) ; 2640 m., Feb. 1933, *Rogers* 575, 581 & 582 ; 2800 m., Jan. 1913, *Grote* 8031 (EA) ; 2600 m., Sept. 1893, *Volkens* 813 (B, holotype destroyed, K, BM, isotypes of *A. kilimandscharica*) ; 4100 m., Dec. 1932, *Geilinger* 5082 ; 3030 m., Feb. 1933, *Rogers* 786 ; 3450 m., March 1936, *Cooper* 24 (BM).

Habitat : moorland, bogs, marshes, streamsides and forest clearings, 1920–4500 m.

Whereas the distribution of the species as a whole is comparatively continuous in the mountains of eastern Africa from northern Ethiopia southwards to Southern Rhodesia, that of the typical subspecies is markedly not so, occurring as it does only at the northern and southern extremities of the range. However, the Southern Rhodesian specimens are quite clearly identical with those from the Anglo-Egyptian Sudan and Ethiopia. Little more than the single character (of whether the leaves are opposite or alternate) separates the two subspecies, but there is a tendency for the leaves of the typical subspecies to be broader in relation to their length even in the larger forms.

Subspecies *meyeri-johannis* is an excessively variable plant as understood here and it seems almost certain that it will be possible to recognise within it at some future date several infra-specific taxa. Fries split it into nine " species " based mainly on leaf shape and size and flower size, many of his species being represented by a single specimen. Ignoring his work and with very many more specimens at my disposal I have in vain looked for any correlation between any of the (admittedly few) characters available. To this end a flower from every specimen was dissected and it was found that although there is a very great variation in size the structure and proportions are in every case identical. (See Fig. 2, 3). The range of length of corolla lobes varies from 3 to 15 mm. the length being constant for any one specimen. A leaf of estimated average size was removed from each specimen and drawn so that details of shape and venation could be better examined. From this it became apparent that although the leaf lengths varied from 4 to 17 mm. and their shapes from suborbicular to oblanceolate, the fundamental shape remains the same in every case. (See Fig. 2, 1 & 2). Fig. 3. is an attempt to show the correlation (or rather the lack of it !) between leaf and corolla length. The horizontal axes represent specimens (a total of 67), the vertical axes lengths in mm. At A the corolla lengths are plotted in a sequence from the largest (15 mm., of which there was 1 specimen) on the left to the smallest (3 mm., of which there were 5) on the right. AA immediately above represents the corresponding leaf length. Thus it can be seen at a glance that there were 11 plants with corollas 8 mm. long, the leaves of these plants varying from 13 to 4 mm. B & BB are a similar pair of graphs but with the leaf length plotted in the lower graph (B) with the corresponding corolla length above (at BB). Thus it can be seen that there were 11 specimens with leaves 9 mm. long, the corollas of these varying from 11 to 3 mm. in length. The other characters used by

Fries, i.e., internode length and pedicel length are quite worthless and determined by the amount of moisture and shade available and the height of the surrounding vegetation respectively. I have indicated on both pairs of graphs the type specimens of the various species reduced in the synonymy given above. Dr. Hedberg carried out cytological investigations on certain of the specimens he collected and the chromosome numbers he obtained are also indicated on the graphs though I am unable to interpret their significance. Apparently the plants with larger parts have larger numbers of chromosomes (2n = 60, 66) than do the plants with medium sized parts (2n = 20, 22). The graph does not indicate the origin of the individual specimens, but beyond certain rather vague tendencies the variation does not seem to be constantly related to distribution either vertical or horizontal. The specimens from Kilimanjaro and especially Elgon tend to show a slightly smaller amount of variation than do those from Mt. Kenya and the Aberdares. The specimens from the lower altitudes (i.e. from within or *below* the montane forest belt) tend to have smaller flowers and broader leaves but not invariably so.

It was considered worthwhile to summate statistically the figures of the 67 specimens measured for leaf length and corolla length in mm. The following are the results :—

	maximum	minimum	mean	S.D. of mean
Leaf length ...	17	4	10·3	3·33
Corolla length ...	15	3	8·2	2·59

Correlation of leaf length and corolla length : r = 0·607

The earliest available epithet for this plant is *meyeri-johannis* Engl., who described it first as a variety of *A. quartiniana* (*A. serpens*) and later raised it to specific rank. The type was destroyed at Berlin but there is a figure in Knuth and I have retained the name in the new rank rather than propose a new one (with a new type) because I prefer to regard the classification adopted here as in a sense temporary and do not wish to embarass future workers on the group with yet more synonyms. Perhaps the solution lies in cytological and genetical study but it is at present difficult to foresee how this can be carried out, the plants occurring as they do at very high altitudes on widely separated mountains.

5. Anagallis angustiloba (Engl.) Engl. in Bot. Jahrb. **30** : 372 (1902) ; Fries, Anag. afr. 334 (1923).

Anagallis quartiniana (A. Rich.) Engl., var. *angustiloba* Engl. in Bot. Jahrb. **28** : 447 (1901).

Anagallis ruandensis Knuth et Mildbr. in Wiss. Erg. deutsch Zent. Afr. Exped. 518 (1911) ; Fries, Anag. afr. 332 (1923) ; Robyns, Fl. Parc Nat. Albert **2** : 41 (1947).

Anagallis churiensis Fries, l.c.

Anagallis kigesiensis Good in Journ. Bot. **62** : 335 (1924).

Anagallis ulugurensis Knuth in Not. Bot. Gart. Berl. **12** : 88 (1934).

Belgian Congo. East of L. Kivu, 2000 m., 1929, *Humbert* 7534 (BR). Kikeri, west of Mikeno, 2240 m., Aug. 1937, *Louis* 5218 (BR) ; ibid., 2200 m., Nov. 1937, *Lebrun* 8509 (BR) ; ibid., 2200 m., Aug. 1937, *Lebrun* 7254 (BR) ; ibid., 2000 m., 1929, *Humbert* 8112 (BR). Nyarusambo, 2000 m., June 1934, *De Witte* 1675 (BR). Tshamagussa, 2500 m., Aug. 1934, *De Witte* 1819 (BR). Lake Kalago, 2300 m., Nov. 1907, *Mildbraed* 1556 (B, holotype of *A. ruandensis*, destroyed). Between Sabinio and Mgahinga, 2000 - 2600 m., June 1929, *Humbert* 8657 (BR).

Uganda. Kigezi District ; Kanaba, 2400 m., Feb. 1945, *Greenway & Eggeling* 7119 & 7119a (K, EA) ; ibid., 2650 m., Sept. 1952, *Norman* 224 (K, EA) ; ibid., 2250 m., Nov. 1934, *G. Taylor* 1828 (BM). Between Sabinio and Mgahinga, 2100 m., *Eggeling* 1102 & 1053 (K, EA) ; ibid., 2400 m., Nov. 1934, *G. Taylor* 1882 (BM). Sabinio, 2400 m., June 1947, *Purseglove* 2441 (K, EA) ; Mgahinga, 3000 m., Oct. 1947, *Purseglove* 2521 (K, EA) ; Buhara, 1800 m., Sept. 1952, *Norman* 148 ; ibid., Sept. 1950, *Purseglove* 3485 (K, EA) ; Behungi, Apr. 1927, *Linder* 2581 ; ibid., 2400 m., Dec. 1930, *Burtt* 2937 (K, EA ; ibid., Jan. 1924, *Godman* 214 (BM, holotype of *A. kigesiensis*) ; ibid., 2100 m., Dec. 1933, *A. S. Thomas* 1060 ; ibid., 2100 m., Nov. 1934, *Synge* 1359 (BM) ; Butale, 1800 m., Nov. 1934, *Synge* 1212 (BM). Toro District ; Ruwenzori, 2400 m., Jan. 1936, *Hancock* 118 36 ; Bwamba Pass, 2400 m., Apr. 1942, *Eggeling* 4974 (EA).

Kenya. Mt. Kenya, Churi, Feb. 1922, *R. E. & Th. C. E. Fries* 1847a (UPS, holotype of *A. churiensis*).

Tanganyika. Lushoto District ; Lukozi, Western Usambaras, 1800 m., May 1953, *Drummond & Hemsley* 2682. Morogoro District ; Uluguru Mts. Lukwangule, 2400 m., Feb. 1933, *Schlieben* 3498 (B, holotype destroyed, BM, isotype of *A. ulugurensis*) ; ibid., 2400 m., Nov. 1898, *Goetze* 294 B, holotype of *A. angustiloba*, destroyed) ; ibid., 2400 m., Jan. 1934, *Michelmore* 910 & 915 (K, EA) ; ibid., 2460 m., Jan. 1930, *Bruce* 718 ; ibid., 2500 m., March 1953, *Drummond & Hemsley* 1569 (K, UPS, EA, BR, etc., neotype of *A. angustiloba* ; ibid., gorge below Hululu Falls, 1500 m., March 1953, *Drummond & Hemsley* 1608.

Habitat : marshes and bogs, 1500–3000 m., (mostly between 2100 and 2400 m.).

The identity of *A. angustiloba* is not absolutely certain, the type specimen having been destroyed at Berlin. I have, however, seen several specimens which originate from the exact type locality of, and agree with the description of *A. angustiloba*. Therefore I have proposed one of these as a neotype, the actual choice, (of *Drummond & Hemsley* 1569), being determined by the large amount of material collected under that number, thus allowing for wide distribution to other herbaria of isoneotypes. As no other species of *Anagallis* has ever been collected to my knowledge in the Uluguru Mts. I feel that the identity of this plant is as certain as is possible in the absence of the actual type.

At first I thought it might be possible to maintain *A. ruandensis* as distinct or at least as a variety of this species. It has a tendency to have opposite leaves whilst those of *A. angustiloba* tend to be alternate. An examination of the large amount of material from the Belgian Congo and Uganda cited above shows however that alternate-leaved shoots are to be found on nearly all of the specimens named *A. ruandensis*. Opposite-leaved shoots also may be found on much of the material of *A. angustiloba* (from the Uluguru Mts.). It is thus possible to certainly distinguish the two only by reference to the locality on the label and as I do not accept this as a valid diagnostic character I have placed *A. ruandensis* in synonymy. The distribution is admittedly rather curious, occurring as this species does on the Belgian Congo–Uganda border, Mt. Kenya, W. Usambara Mts and Uluguru Mts. The specimens from Mt. Kenya and the W. Usambara Mts. however, agree exactly with those from the

western part of the range (i.e. they have mainly opposite leaves). If the respective distributions of this species and *A. serpens* ssp. *meyeri-johannis* are compared it is of interest that this species occurs at a somewhat lower altitude mostly on those East African mountains from which the latter is apparently absent, Mt. Kenya being the only mountain upon which both occur. (See Fig. 4, 5–8).

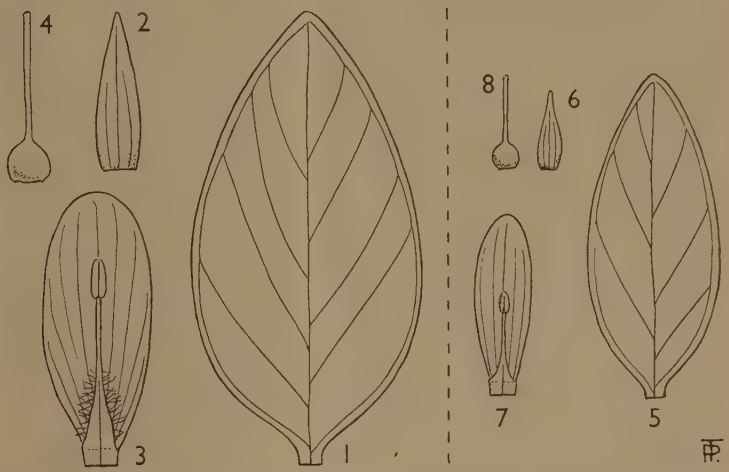

FIG. 4. *Anagallis hexamera* P. Tayl.—1, leaf ; 2, calyx lobe ; 3, corolla lobe and attached stamen ; 4. pistil. *Anagallis angustiloba* (Engl.) Engl.—5, leaf ; 6, calyx lobe ; 7, corolla lobe and attached stamen ; 8, pistil, all × 4.

6. Anagallis hexamera P. Tayl. sp. nov. *A. angustilobae* (Engl.) Engl. affinis, sed omnino major, floribus hexameris necnon filamentis staminum inferne ciliatis.

Herba repens, perennis, staminibus exceptis omnino glabra. *Caules* e nodis inferioribus radices emittentes, rubescentes, 1–1·5 mm. crassi, leviter angulares, simplices vel raro ramosi, usque ad 60 cm. longi ; internodia 1–3 cm. longa. *Folia* opposita [vel raro alterna], integra, anguste ovata, apice subacuta, basi in petiolum brevem 2 mm. longum cuneata, lamina usque ad 25 mm. longa et usque ad 10 mm. lata. *Flores* [suaveolentes], ex axillis partis caulis superioris exorientes, longe pedicellati, hexameri [nonnunquam pentameri raro usque ad octomeri]. *Pedicelli* graciles, anthesi erecti necnon usque ad 3 cm. longi, fructu reflexi necnon usque ad 6 cm. longi. *Calyx* fere ad basim divisus, lobis anguste lanceolatis acutis trinerviis. *Corolla* subcampanulata, rosea, tubo brevissimo circiter 0·5 [1·0] mm. longo, lobis oblongis [usque ad anguste obovatis] apice obtusis [vel rotundatis] [9 ·] 10[·12] mm. longis [3]4 mm. latis [7–]11-nerviis. *Stamina* isomera ; filamenta circiter 6·5 mm. longa, basi in tubum brevissimum connata, tubo ipso 0·5[-1·0] mm. longo ad tubum corollae omnino adnato, parte filamentorum libera dimidio inferiore leviter dilatata margine ciliata, dimidio superiore filiformi et glabra ; antherae oblongae, [1–]1·4 mm. longae. *Ovarium* globosum, circiter 1·5 mm. diametro, stylo filiformi circiter

4·5 mm. longo. *Pyxidium* globosum, circiter 3 mm. diametro, stylo persistente. *Semina* trigona, minute papillosa, 0·8–1 mm. longa.

Ethiopia. 30 miles NW. of Addis Ababa, 2400 m., in damp grass near opening in orchard, May 10, 1953, *Mooney* 4785 :—a trailing herb with pink scented flowers (K, UPS).

Kenya. Rift Valley Province ; Ravine District ; Timboroa, 2400 m., common in swamp near the forest with *Lobelia aberdarica* and *Aloe*, June 14, 1953, *G. R. Williams* & *Piers* 560 :—procumbent herb with pink flowers and stem (K, holotype, EA, isotype) ; Mau Range, 2600 m., 10 km. north of Timboroa in a small swamp, June 2, 1948, *Hedberg* 1085 (UPS). Nakuru District, Ol-joro-orok, 2340 m., Jan. 1932, *Pierce* 1656 :—flowers pink (K, EA) ; Uasin Gishu District, Uasin Gishu Plateau, 1918, *Dowson* 664 ; "Nandi, Nile", 2100–2400 m., Dec. 1893, *Scott Elliot* 6879 :—in long grass. Central Province ; North Nyeri District, Naro Moro, Aug. 1933, *Jex-Blake* 6144 (EA) "Masailand" 1906, *Mrs. Cholmley* s.n. (BM).

Habitat : swamps and damp grassland, 2100–2600 m.

This species is very closely related to *A. angustiloba*, (see Fig. 4, 1–4), but constantly differs in its much larger size, bearded stamens and usually hexamerous flowers. Its vertical range is much the same as that of *A. angustiloba*. The specimen from Ethiopia, despite the distance involved, is identical with those from the Kenya highlands in every respect save one. Of the several shoots collected under *Mooney* 4785, most have opposite leaves, but one has them alternate, whereas all of the material seen from Kenya has opposite leaves. I do not, however, consider this character to be of any importance, *A. angustiloba* having opposite or alternate leaves more or less throughout its range. The close relationship between the two species is emphasized by the fact that a rather luxuriant specimen of *A. angustiloba* (*Eggeling* 1102) has a tendency to have at least some flowers hexamerous. Further research may prove the two to be chromosome races of one species but on the present evidence I prefer to treat them as distinct.

Subgenus 3. CENTUNCULUS (L.) P. Tayl. stat. nov.

Centunculus L., Sp. Pl. 116 (1753) ; Hook. f. in Benth. et Hook. f., Gen. Pl. **2** : 637 (1876) ; Knuth, Pflanzenr. 334 (1905).

Anagallidastrum Mich. ex Adans., Fam. **2** : 230 (1763).

Micropyxis Duby in DC., Prodr. **8** : 71 (1844).

Anagallis sect. Micropyxis (Duby) Knuth, Pflanzenr. 331 (1905).

7. Anagallis kochii Hess in Berichte der Schweizerischen Botanischen Gesellschaft **63** : 213 (1953).

Angola. Serra da Chela, Huilla Plateau, 1850 m., May 1952, *Hess* 52/1830 (Z, holotype not seen, K, isotype).

Habitat : shallow pools, 1850 m.

This extraordinary plant is known only from the single gathering cited and is the only truly aquatic member of the genus. It is readily distinguished from all others by that fact alone. In the absence of knowledge as to habit it might be confused with *A. filifolia* but that species has acutely pointed sepals and much shorter pedicels. My grateful thanks are due to Herr Hans Hess of Zurich, who kindly presented the Kew Herbarium with a part of the type gathering.

8. Anagallis filifolia Engl. et Gilg, Kunene Samb. Exped. 325 (1903); Knuth, Pflanzenr. 334 (1905).

Angola. Kubango near Kohi, 1350 m., May 1900, *Baum* 906 (B, holotype destroyed, K, BM, isotypes) ; ibid., May 1906, *Gossweiler* 3935 (BM).

Habitat : marshy ground.

Known only from the specimens cited from Angola, this species differs from *A. kochii* as detailed above and from *A. elegantula* by its rounded, not acuminate, corolla-lobe apices, and much longer, narrower leaves.

9. Anagallis elegantula P. Tayl. nom. nov.

Anagallis pulchella Welw. ex Schinz in Bull. Herb. Boiss. **2** : 221 (1894) ; Hiern, Cat. Afr. Pl. Welw. **3** : 635 (1898) ; Knuth, Pflanzenr. 333 (1905)—non. Salisb., Prodr. 120 (1796).

Anagallis dekindtiana Gilg ex Knuth l.c. pro syn.

Belgian Congo. Kisantu, Mwana Mutombo, April 1953, *Callens* 3942.

Northern Rhodesia. Mwinilunga District ; Sinkabolo Dambo, Nov. 1937, *Milne-Redhead* 3210 ; Abercorn District ; Feb. 1952, *Richards* 753. Luangwa District, Lukanda valley, Feb., *Allen* 457.

Angola. Benguela ; Babaéra, 1500 m., Dec. 1932, *Gossweiler* 9708. Ganda ; Alto Catumbela, 1350 m., Jan. 1940, *Faulkner* A31 ; ibid., Nov. 1941, *Faulkner* A94. Huilla ; Monino River, Nov.–Dec. 1859, *Welwitsch* 276 (Z, holotype not seen, K, BM, isotypes) ; near Lopollo, Dec. 1859, *Welwitsch* 276b & 276c (BM). Moxico ; River Ysenga, Jan. 1938, *Milne-Redhead* 4131.

Habitat : marshes, swamps and damp pastures.

It is unfortunate that Schinz was unaware of the previous use of the epithet *pulchella* in the genus when he took up the manuscript name given to the plant by Welwitsch. The name *dekindtiana* being published in synonymy is also invalid. *A. baumii* Knuth, (see end), if it prove to be conspecific with the present species, will provide the earliest valid name, but as it seems unlikely that such proof will be forthcoming (the type, a unicate in the Berlin herbarium, having been destroyed), I have proposed a new name.

A. elegantula is rather variable in leaf width, both Welwitsch and later Milne-Redhead recording this fact in the field. The narrower-leaved forms are superficially similar to *A. filifolia* but it may be distinguished from that species as detailed above.

10. Anagallis acuminata Welw. ex Schinz in Bull. Herb. Boiss. **2** : 221 (1894) ; Hiern, Cat. Afr. Pl. Welw. **3** : 636 (1898) ; Knuth, Pflanzenr. 333 (1905).

Southern Rhodesia. Salisbury, Chindamora Reserve, Ngomakarira, 1650 m., March 1952, *Wild* 3784 (SRGH, K) ; Domboshawa, 1350 m., March 1950, *Wild* 3242 (SRGH, K).

Northern Rhodesia. Kasama, 1200 m., March 1955, *Richards* 5269a.

Angola. Mossamedes, Huilla, Morro de Lopollo, 1700 m., *Welwitsch* 275 (Z, holotype not seen, K, BM, isotypes).

Habitat : damp ground by streams, 1200–1700 m.

Although this species closely resembles *A. elegantula* it constantly differs in the smaller size of all its parts and its simple habit.

11. Anagallis rhodesiaca R. E. Fries, Wiss. Ergebn. Schwed. Rhod. Congo Exped. 1911–12, **1** : 253 (1916).

Northern Rhodesia. Kali, between Fort Rosebery and Lake Bangweolo, Sept. 1911, *R. E. Fries* 634 (UPS, holotype, K, isotype).

Habitat : damp meadow.

Known only from the single gathering cited, this species closely resembles *A. acuminata* in its simple habit but may be distinguished by its even smaller size and its glabrous filaments.

12. Anagallis tenuicaulis Bak. in Journ. Bot. **20** : 172 (1883) ; Knuth, Pflanzenr. 332 (1905) partim quoad spec. *Baron* 240.

Anagallis hanningtonii Bak. in Kew Bull. 1901 : 127 (1901).

Anagallis pumila Sw. var. *natalensis* (Schltr.) Knuth, l.c. 332 (1905) ; Harv. in Dyer, Fl. Cap. **4** (**2**) : 429 (1906).

Anagallis natalensis Schltr. ex Knuth, l.c. 332 (1905) pro syn.

[*Anagallis arvensis* L. var. *phoenicea* (non (Scop.) Gren. et Godr.)—Knuth, l.c. 324 (1905)].

Uganda. West Nile District ; Logiri, *Eggeling* 1876. Masaka District ; Lake Nabugabo, 1125 m., Oct. 1932, *Eggeling* 962. Soroti District ; Omunyal Swamp, 1080 m., Sept. 1954, *Lind* 358.

Kenya. Uasin Gishu District ; Kipkarren, 1800 m., Sept. 1931, *Broadhurst Hill* 285. South Kavirondo District ; Lolgorien, 1500 m., Sept. 1935, *Napier* 6098 (EA).

East Africa, possibly Tanganyika. Without locality, *Hannington* s.n.

Southern Rhodesia. Chipetzana R., near Wolverhampton, 1050 m., *Swynnerton* 357 (K, BM).

Northern Rhodesia. Abercorn District ; near Abercorn, 1500 m., Jan. 1952, *Richards* 324 & 526 ; ibid., Dec. 1949, *Bullock* 2116 ; ibid., Jan. 1952, *Nash* 32 BM ; ibid., Fwambo, Jan., *Carson* 45 & 72 (K, syntypes of *A. hanningtonii*).

Angola. Malange, Sept. 1932, *Young* 884 (BM).

Madagascar. Betsileo-land, *Baron* 240 (K, holotype of *A. tenuicaulis*) ; Ankafana, *Cowan* s.n. (BM).

Natal. Inanda, Jan., *Wood* 1609 (K, BM, isotypes of *A. pumila* var. *natalensis*). Port Natal, *Sanderson* 685. Without locality, *Gerrard* 741.

Habitat : marshes and damp grassland.

Knuth was very far from correct in tentatively placing *A. hanningtonii* in the synonymy of *A. arvensis*. The type specimens of *A. natalensis* and *A. tenuicaulis* are rather poor but I have no doubt that the above synonymy is correct. *A. tenuicaulis* is closely related to *A. pumila* but constantly differs in a number of characters (vide key and Fig. 5, 14–15). In addition I suspect that it may be a perennial. The leaves on some of the specimens of this species show a strong tendency to be opposite and when this is the case there is a superficial resemblance to *A. angustiloba*. However, the absence of roots at the nodes, the winged stem and the bearded filaments enable this to be readily distinguished from that species.

13. Anagallis pumila Sw., Prodr. veg. Ind. occ. **1** : 40 (1788) ; St. Hil. et de Gir., Monog. Prim. et Lent. 7 (1837), et in Ann. Sci. Nat. 2nd sér. **11** : 90 (1839) partim excl. var. *ruizii* ; Benth., Fl. Austral. **4** : 270 (1869) ; Hiern, Cat. Afr. Pl. Welw. **3** : 635 (1898) ; Knuth, Pflanzenr. 331 (1905) partim excl. var. *ovalis* pro parte et var. *natalensis* ; Ewart & Davies, Fl. N.T. (Austral.) 216 (1917) ; Hutch. & Dalz., Fl. W. Trop. Afr. **2** : 184 (1931).

var. α pumila

Anagallis pumila Sw., Prodr. veg. Ind. occ. **1** : 40 (1788) ; Hiern, Cat. Afr. Pl. Welw. **3** : 636 (1898) partim excl. spec. Welwitsch 273 et 273b ; Hutch. & Dalz., Fl. W. Trop. Afr. **2** : 184 (1931) partim excl. syn. *A. djalonis*.

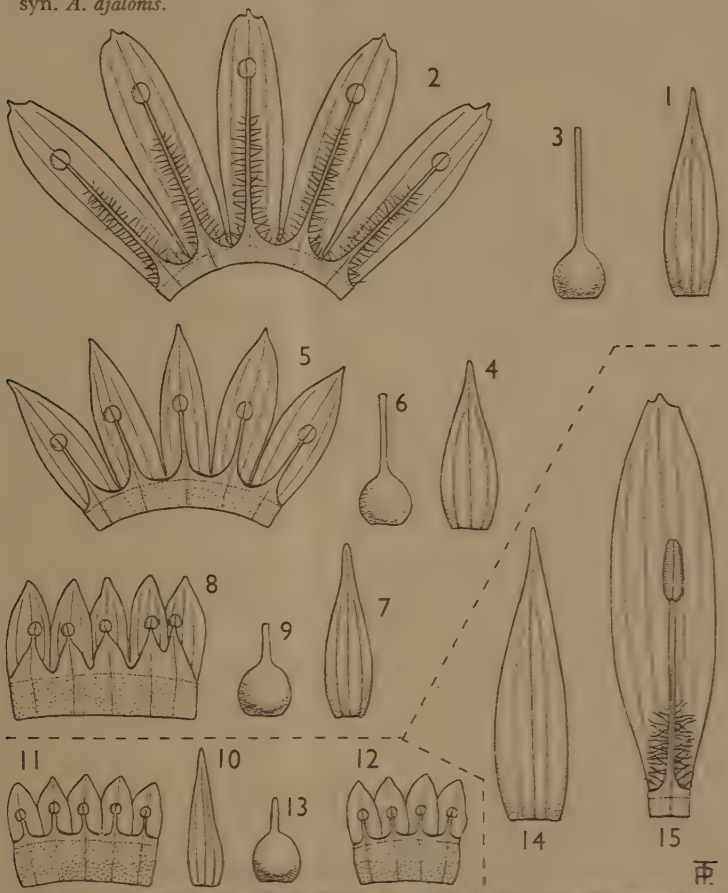

FIG. 5. *Anagallis pumila* Sw., var. *barbata* P. Tayl.—1, calyx lobe ; 2, corolla opened out to show stamens ; 3, pistil. *Anagallis pumila* Sw., var. *pumila*—4, calyx lobe ; 5, corolla opened out to show stamens ; 6, pistil. *Anagallis pumila* Sw., var. *djalonis* A. Chev. P. Tayl.—7, calyx lobe ; 8, corolla opened out to show stamens ; 9, pistil. *Anagallis minima* L. Krause—10, calyx lobe ; 11, 12, corollas opened out to show stamens ; 13, pistil. *Anagallis tenuicaulis* Bak.—14, calyx lobe ; 15, corolla lobe and attached stamen, all × 8.

Anagallis ovalis Ruiz. et Pav., Fl. Peruv. et Chilens. **2** : 8 (1799).

Centunculus pentandrus R. Br., Prodr. 427 (1810) ; Miq. in Mart., Fl. Bras. **10** : 263 (1856) partim excl. var. *ruizii* ; Miq. in Fl. Ned. Ind. **2** : 1004 (1859) ; Griseb., Fl. Brit. W. Ind. Isl. 390 (1861) ; A. Gray, Syn. Fl. N. Am. **2** (**1**) : 400 (1886) ; Chod. et Hassl. in Bull. Herb. Boiss. sér. 2, **3** : 912 (1903).

Anagallis pumila Sw. var. *linum-stellatum* St. Hil. et de Gir., Monog. Prim. et Lent. 4 (1837), et in Ann. Sci. Nat. 2nd sér. **11** : 89 (1839).

Anagallis pumila Sw. var. *compacta* St. Hil. et de Gir., l.c. 90 (1839).

Anagallis pumila Sw. var. *elongata* St. Hil. et de Gir., l.c. 90 (1839).

Anagallis pumila Sw. var. *distans* St. Hil. et de Gir., l.c. 90 (1839).

Centunculus indicus Royle, Ill. Bot. Himal. 310 (1839).

Anagallis alba Buch. Ham. in Wall. Cat. ex Steud., Nom. ed. 2, **1** : 83 (1840).

[*Lysimachia tenella* (non L.)—Wall. Cat. no. 1491].

Micropyxis elongata Duby in DC., Prodr. **8** : 71 (1844).

Micropyxis pumila (Sw.) Duby in DC., Prodr. **8** : 72 (1844) ; A. DC., Geog. Bot. 1035 (1855) ; Small., Man. S.E. Flora 1026 (1933).

Anagallis pedunculata Salzm. ex Duby in DC., Prodr. **8** : 72 (1844) pro syn.

Micropyxis pumila (Sw.) Duby var. *ovalis* (Ruiz et Pav.) Duby in DC., Prodr. **8** : 72 (1844) partim, excl. syn. *Anagallis sessilis*.

Centunculus tenellus Duby in DC., Prodr. **8** : 72 (1844) ; Hook. f., Fl. Brit. Ind. **3** (**1**) : 506 (1882).

Micropyxis tenella Wight, Icon. **4** : t. 1585 (1850).

Centunculus pentandrus R. Br. var. *linum-stellatum* (St. Hil. et de Gir.) Miq. in Mart., Fl. Bras. **10** : 263 (1856).

Centunculus pentandrus R. Br. var. *compacta* (St. Hil. et de Gir.) Miq. in Mart., l.c. 263 (1856).

Centunculus pentandrus R. Br. var. *elongata* (St. Hil. et de Gir.) Miq. in Mart., l.c. 264 (1856).

Centunculus pentandrus R. Br. var. *distans* (St. Hil. et de Gir.) Miq. in Mart., l.c. 264 (1856).

Centunculus pentandrus R. Br. forma *longepedunculata* Chod. et Hassl. in Bull. Herb. Boiss., sér. 2, **3** : 912 (1866).

Centunculus pentandrus R. Br. var. *stellatus* (St. Hil. et de Gir.) Chod. et Hassl., l.c. 912 (1866).

Centunculus pumilus (Sw.) O. Kuntze, Rev. Gen. **3** (**2**) : 193 (1891).

Centunculus pumilus (Sw.) O. Kuntze var. *pentandrus* (R. Br.) O. Kuntze, Rev. Gen. **3** (**2**) : 193 (1891).

Centunculus pumilus (Sw.) O. Kuntze var. *ovalis* (Ruiz et Pav.) O. Kuntze, Rev. Gen. **3** (**2**) : 193 (1891) partim excl. syn. var. *ruizii*.

Anagallis pumila Sw. var. *ovalis* (Ruiz et Pav.) Knuth, Pflanzenr. 332 (1905) partim excl. syn. *Anagallis sessilis*.

Anagallis micropetala Poeppig ex Knuth, Pflanzenr. 331 (1905) pro syn.

Anagallis pumila Sw. var. *longepedunculata* (Chod. et Hassl.) Knuth, Pflanzenr. 332 (1905) pro max. parte excl. Afr. spec. Welwitsch 273, 273b, Hildebrandt 1147, Schweinfurth 2562.

Anagallis nana Schinz in Vierteljahrsschr. Nat. Ges. Zurich **55** : 244 (1910).

[*Anagallis djalonis* (non A. Chev.)—A. Chev., Expl. Bot. **1** : 384 (1920) partim quoad spec. Chevalier 20384].

French Guinea. Between Kouloundala and Kaba, Jan. 1909. *Chevalier* 20384 P.

Nigeria N.. Lokoja, Nov. 1908. *Dalziel* 52. Bauchi Plateau, Sept. 1930. *Lely* 728. Zaria District : Anara Forest Reserve, Sept. 1948. *Olorunfemi*, F.H.I. 24394.

Kenya. Nairobi : Thika Road House, July 1951, *Verdcourt* 534 partly K, EA.

Tanganyika. Kilwa District : Rufiji R., 200–400 m., June 1932, *Schlieben* 2475 BM.

Southern Rhodesia. Salisbury : Makabusi River, 1350 m., Apr. 1948, *Wild* 2513 (K, SRGH).

Angola. Huilla : Morro de Monino, 1590 m., Apr. 1860, *Welwitsch* 274 BM.

S.W. Africa. Tsumeb, Apr. 1934, *Dinter* 7446 & 7602.

Transvaal. Rietfontein, 1830 m., Oct. 1893, *Schlechter* 3569 K, BM, isotypes of *A. nana*).

I have also seen the following from other parts of the world :—

India. Madras : Hosur, *Clarke* 13958. Bombay : Yellapur, *Talbot* 982. Orissa : Keonjhar, *Mooney* 2781 : Sambalpur, *Mooney* 2912. Bihar : Hazaribagh, *Clarke* 25932 : Manbhum, *Clarke* 25244 : Parasnath, *Clarke* 20242, 33795 K, BM : Singhbhum, *Clarke* 34155, *Haines* 5691 : Ranchi, *Clarke* 20947 : Lohardugga, *Clarke* 25165. Uttar Pradesh : Dehra Dun, *Gamble* 27445, 24615 : Kumaon, *Wallich* s.n. : Nepal : *Wallich* s.n.

Malay Islands. Timor ; Kasilioe, May 1929, *Walsh* 448a (BM).

Australia. Northern Territory : Bickerton Island, *Specht* 486 : Gulf of Carpentaria, *F. Mueller* s.n. Queensland : Shoalwater Bay, *R. Brown* 2814 BM, holotype of *Centunculus pentandrus*).

Central America. Mexico : Vera Cruz, *Mueller* 313 : ibid., *Purpus* 2377 BM : Temascaltepec, *Hinton* 5200 K, BM. British Honduras : Maskall, *Gentle* 1095. Guatemala : Coban, *Turckheim* 355 K, BM : Cerro Redondo, *Heyde & Lux* 6064 K, BM. Costa Rica : Vara Blanca de Sarapiqui, *Stork* 3572 : La Palma, *Tonduz* 7461 : San José, *Tonduz* 7324 (BM) ; San Pedro, *Tonduz* 9853 (BM).

West Indies. Jamaica : without loc., *Swartz* s.n. BM, holotype of *Anagallis pumila*. Cuba : without loc, *Wright* 2889 K, BM. Isla de Pinos : Nueva Gerona, *Curtiss* 230 (K, BM) ; Santa Barbara, *Ekman* 12035 (BM).

E. Tropical S. America. Brazil : Rio de Janeiro, *Glaziou* 11396, 14190 : Rio Branco, *Ule* 8257 : Govaz, *Gardner* s.n. : ibid., *Burchell* 5697, 6915, 7180 : Bahia, *Salzmann* s.n. K, isotype of *Anagallis pedunculata* ; ibid., *St. Hilaire* s.n. K, isotype of *Anagallis pumila* var. *linum-tellurum*. Paraguay : without loc., *Hassler* 6437 BM : Igatimi, *Hassler* 5505 (K, BM) ; L'Assomption, *Balansa* 2399.

W. Tropical S. America. Venezuela ; Caracas, *Birschel* s.n. ; Tovar, *Fendler* 2016 : without loc., *Funck & Schlim* 1205 BM. Colombia : Popayan, *Lehmann* 5999 : Tolima, *Pennell* 3545 : Meta, *Pennell* 1553 : Santa Marta, *H. H. Smith* 1311 K, BM. Ecuador : Ventanas, *Spruce* 6479 K, BM. Peru : Tarapoto, *Spruce* 4451 K, BM : Jequan, *Ruiz & Pavon* 97 K, ? part of type material of *Anagallis ocalis*. Bolivia : Apolo, *Williams* 93, 188.

var. β barbata P. Tayl. var. nov. a var. *pumila* lobis corollae paulum longioribus, filamentis inferne barbatis differt. Africae tropicae solum incola.

[*Anagallis pumila* non Sw. sens. str. Hiern, Cat. Afr. Pl. Welw. **3** : 635 1898 partim quoad spec. Welwitsch 273 et 273b : Hutch. & Dalz., Fl. W. Trop. Afr. **2** : 184 1931 partim quoad spec. Barter 784].

[*Anagallis pumila* Sw. var. *longepedunculata* non Chod. et Hassl. Knuth — Knuth, Pflanzenr. partim quoad Afric. spec. Welwitsch 273 et 273b, Hildebrandt 1147, Schweinfurth 2562].

French Sudan. Kita Massif, 600 m., Sept. 1943, *Jaeger* s.n.

Nigeria (N.). Borgu, *Barter* 784.

Belgian Congo. Garamba, July 1952, *Troupin* 1567 (BR).

Anglo-Egyptian Sudan. Djur Land, 260 m., 1867, *Schweinfurth* 2562.

Uganda. Mt. Elgon, 2100 m., Sept. 1954, *Lind* 246.

Kenya. Nairobi : 1650 m., *Dawson* 406 : Thika Road House, July 1951, *Verdcourt* 534 partly K, EA. Kiambu District : Kiambu, 1710 m., July 1932, *Mainwaring* 2164 K, EA : Ruiri, 1620 m., Aug. 1930, *Napier* 376 K, EA.

Tanganyika. Mwanza District ; Ukerewe Island, July 1928, *Conrads* 900 (K, EA). Arusha District ; Moshi, 1050 m., *Haarer* 1530 (K, EA). Tanga District ; Korogwe, 300 m., July 1953, *Drummond & Hemsley* 3379 ; ibid., Magunga Estate, 300 m., damp ground, Aug. 1953, *Faulkner* 1230, (K, holotype, UPS, isotype of var. *barbata*) : —small plants with white flowers ; common in many areas of damp ground (seasonal wet pans and tracks through the plantation). Njombe District ; Lupembe, Ruhudje R., May 1931, *Schlieben* 888 (BM).

Zanzibar. Kidoti, 1873, *Hildebrandt* 1147 (K, BM).

Portuguese East Africa. Quelimane, Aug. 1887, *Scott* s.n.

Southern Rhodesia. Salisbury, 1470 m., Apr. 1948, *Greatrex* S.R.G.H. 20042. Bulawayo, 1340 m., Feb. 1912, *Rogers* 5750. Without locality, April 1926, *Rand* 66 (BM).

Northern Rhodesia. Broken Hill, 1200 m., June 1909, *Rogers* 8159. 22 miles north of Choma, 1170 m., May 1954, *Robinson* 786.

Angola. Pungo Andongo ; Sansamanda, Feb. 1857, *Welwitsch* 273 (K, BM) ; between Condo and Quisonde, March 1857, *Welwitsch* 2736b (BM).

var. γ djalonis (A. Chev.) P. Tayl. stat. nov.

Anagallis djalonis A. Chev. in Journ. de Bot. sér. 2, **22** : 115 (1909) ; A. Chev., Expl. Bot. **1** : 384 (1920).

[*Anagallis pumila* (non. Sw. sens. str.) Hutch. & Dalz., Fl. W. Trop. Afr. **2** : 184 (1931) partim quoad syn. et spec. *Chevalier* 20193].

French Guinea. Fouta Djalon ; Dalaba Plateau, 1000–1300 m., Oct. 1907, *Chevalier* 18876 (P, holotype, K, isotype of *A. djalonis*) ; ibid., Oct. 1907, *Chevalier* 20193 (P) ; ibid., Sept. 1907, *Chevalier* 18668 (P).

Kenya. Uasin Gishu District ; Kipkarren, Oct. 1931, *Broadhurst Hill* 551 (K, EA).

Tanganyika. Rungwe, Sept., *Geilinger* 2467.

Northern Rhodesia. Mumbwa, 1911, *Macaulay* 799. Mufulira, May 1934, *Eyles* 8344.

Angola. Lunda, Xa Senue, 1200 m., Apr. 1937, *Exell & Mendonça* 443 (BM).

Habitat of the species : damp ground, swamps, etc., sea level to 2100 m.

I have cited above all of the specimens that I have seen of this curious and much misunderstood little plant. It can be seen that it is more or less pan-tropical in its distribution, the two varieties however being confined to tropical Africa. Although both of these varieties differ markedly in the structure of their flowers from the typical variety (see Fig. 5, 1–9) they are more or less indistinguishable vegetatively. Between the extremes figured for the three varieties a few specimens have been found to be more or less intermediate. For instance some of the specimens referred to var. *barbata* have corolla lobes of a length within the range (vide key) given for var. *pumila*, and the hairs on the stamens, though always present, are greatly reduced in number. The var. *djalonis* is rather more constantly distinct but the degree to which the free part of the filament is dilated is somewhat variable. It is additionally distinguished by having its seeds 0·45–0·65 mm. long, those of the other vars. being from 0·3–0·45 mm. long.

The rather comprehensive synonymy given above is, I hope, more or less complete. The wide distribution and the doubt as to whether it should be placed in *Anagallis*, *Centunculus* or a third genus *Micropyxis* are the main reasons for the rather large number of names which have been given to this species. Further confusion has arisen due to the misidentification of this with the following species (*A. minima*). The *A. ovalis* of Ruiz and Pavón is an example of this. There is a specimen in the Kew herbarium which appears to be part of the type of *A. ovalis* and is, in fact,

a form of *A. pumila* with very short pedicels (a character in my opinion of no taxonomic significance in this species). St. Hilaire and de Girarde reduced *A. ovalis* to the rank of variety (var. *ruizii*) under *Centunculus pentandrus* and give as a synonym *A. sessilis* Salzmann. However, there is an isotype of the latter at Kew and it proves to be *A. minima*. O. Kuntze and Knuth subsequently retained the Ruiz and Pavón species as a variety (var. *ovalis*) under *Centunculus pumilus* and *Anagallis pumila* respectively and continued to cite *A. sessilis* as a synonym. The specimens cited under this variety by the latter author are, in fact, a mixture of *A. pumila* and *A. minima*. Knuth was more than a little vague on this point as he states that *Centunculus minimus* is confined to the northern hemisphere and proceeds to cite specimens from Argentina!

Knuth also keys out *A. pumila* as being procumbent and figures a plant which is rooting at the nodes. None of the large number of specimens examined and cited above has been observed to do this and I can only conclude that the specimen he figures is abnormal. Annual plants, especially those which grow in damp places as this species does, if damaged or knocked over early in their development, will sometimes survive by producing adventitious roots.

14. Anagallis minima (L.) Krause in Sturm, Fl. Deutsch. ed. 2, **9** : 251 (1901) ; Hermann, Fl. Deutsch. & Fennoskand. 367 (1912).

Centunculus minimus L., Sp. Pl. 116 (1753) ; St. Hil. et de Gir., Monog. Prim. et Lent. 4 (1837) et in Ann. Sci. Nat., 2nd sér. **11** : 88 (1839) ; Miq. in Mart., Fl. Bras. **10** : 263 (1856) ; Vatke in Linnaea **40** : 205 (1876) ; Oliv., Fl. Trop. Afr. **3** : 490 (1877) ; Knuth, Pflanzenr. 334 (1905) ; et plerique auctores Eur. et Amer. bor.

Anagallis centunculus Afzel., Veget. Suecan. 1 (1785).

Anagallis pusilla Salisb., Prodr. 121 (1796).

Centunculus lanceolatus Michx., Fl. bor. Amer. **1** : 93 (1803).

Centunculus simplex Hornem. in Fl. Dan. **9** : t. 1567 (1818).

Anagallis pumila Sw. var. *ruizii* St. Hil. et de Gir., Monog. Prim. et Lent. 8 (1837) et in Ann. Sci. Nat., 2nd sér. **11** : 89 (1839) ; Miq. in Mart., Fl. Bras. **10** : 263 (1856) partim excl. syn. *Anagallis ovalis*.

Anagallis sessilis Salz. ex Duby in DC., Prodr. **8** : 72 (1844) pro syn.

[*Centunculus tenellus* (non. Duby)—Wight, Icon. **6** : t. 2000 (1853)].

Anagallidastrum exiguum Bub., Fl. pyr. **1** : 238 (1897).

Centunculus mexicanus Schaffn. ex Knuth, Pflanzenr. 334 (1905) pro syn.

[*Anagallis pumila* Sw. var. *ovalis* (non (Ruiz et Pav.) Knuth)—Knuth, Pflanzenr. 332 (1905) partim quoad syn. *Anagallis sessilis* et spec. Mandon 1496].

Micropyxis exigua (Bub.) Lunell in Ann. Midl. Nat. **4** : 506 (1916).

Ethiopia. Mt. Semajata, 2940 m., Oct. 1862, *Schimper* 540 (B, destroyed).

Habitat : in Africa not known ; elsewhere in damp places, from sea level in Europe, (and tropical Brazil !) to 3800 m. in the Andes.

I have seen the following from other parts of the world :—

India. Madras ; Nilgiri Hills, *Perrottet* 704 ; ibid., *Foulkes* s.n. ; ibid., *Schmid* s.n. (BM).

Central America. Mexico ; San Luis Potosi, *Schaffner* 124 K. isotype of *Centunculus mexicanus*) ; ibid., *Parry & Palmer* 569½.

E. Tropical S. America. Brazil ; Bahia, *Salzmann* s.n. (K, isotype of *Anagallis sessilis*). Paraguay ; Ibitimi, *Balansa* 2396 ; Cerros de Tobaty, *Hassler* 6436 BM .

W. Tropical S. America. Peru ; Capachica Peninsula, *Tutin* 1094 (BM). Bolivia ; Larecaja, *Mandon* 1496 (K, BM). Ecuador ; Guaranda, *André* 3979 ; Valle de Leito, *Spruce* 5201 (K, BM) ; Guarapata, *Spruce* 5201.

Temperate S. America. Chile ; Catapilco, *Reed* s.n. Argentina ; Cordoba, *Lorentz* s.n.

In addition to the specimens cited above I have seen numerous examples from Europe and N. America but as there has never been any doubt as to their identity (as *Centunculus minimus*) I do not consider it necessary to cite them.

I have not seen the single specimen cited from Tropical Africa but see no reason for doubting the correctness of Vatke's determination. The distribution of this, probably one of the smallest of phanerogamic plants, presents some interesting features. Whilst its presence on high mountains in the tropics, under more or less temperate conditions, is not difficult to understand, its occurrence in tropical Brazil at sea level is rather puzzling. The specimen in question is, however, identical in every respect to those from Europe and N. America.

The close similarity of the floral structure between this species and the varieties *pumila* and *djalonis* of *A. pumila* can be seen in Fig. 5, 1–13. From the former variety it may usually be distinguished by its sessile flowers and the relative lengths of the adnate and filiform parts of the stamens and the fact that its corolla is always shorter than its calyx. From the subsessile flowered forms of that variety it differs in the floral characters only. From the var. *djalonis* it constantly differs in its sessile flowers and narrower leaves.

Imperfectly Known Species

Anagallis (subgen. JIRASEKIA, sect. ? Jirasekia) **kingaënsis** Engl. in Bot. Jahrb. **30** : 371 (1901) ; Knuth, Pflanzenr. 328 (1905) ; Fries, Anag. afr. 337 (1923).

Tanganyika. Kinga Mountains, 2200 m., May 1899, *Goetze* 958 B, holotype destroyed).

I have been unable to trace the existence of a duplicate of the above specimen in any herbarium and until the southern Tanganyika highlands are intensively and carefully recollected this species must remain an unkown quantity. Knuth distinguishes it in his key from *A. nummulariifolia* as follows :—

Pedicelli foliis vix aequilongi — *A. kingaënsis*

Pedicelli folia duplo saltem superantes — *A. nummulariifolia*

In his description (which agrees with that of Engler), however, he gives the pedicel length as equal to the petiole (1 mm.), presumably at anthesis, and as 4–5 times as long as the leaf in fruit. Fries, who does not state whether he saw the specimen or not, relates it to *A. kilimandscharica* and related species. Engler's description does not mention the degree to which the filaments are connate so it is impossible even to place it certainly in the correct section.

Anagallis (subgen. JIRASEKIA, sect. JIRASEKIA) **sp.**

NYASALAND. Mt. Mlanje, *McClounie* s.n. (comm. Johnston 1896).

The specimen cited above is rather inadequate and I hesitate to describe a new species in such a critical group, on the evidence of a single specimen. On dissection the flowers are found to have stamens connate in the lower third, the connate part however being completely glabrous, this latter character distinguishing it from all the other species in the section. The leaves are orbicular and alternate and the plant agrees remarkably well in most other characters with the description of *A. kingaënsis*. However, until that species has been re-collected and the structure of its stamens determined I feel it would be unwise to identify the present specimen with it. Geographically it is not unlikely that a species should occur in S. Tanganyika and Nyasaland.

Anagallis (subgen. CENTUNCULUS) **baumii** Knuth, Pflanzenr. 333 (1905).

[*A. pulchella* (non Welw. ex Schinz)—Engl. et Gilg in Kunene-Sambesi Exped. 325 (1903) fide Knuth l.c.].

ANGOLA. Bié: Minnesera, upper part of Longa (River), 1275 m., Feb. 1900, *Baum* 710a (B, holotype destroyed).

If Engler and Gilg l.c.) were correct in identifying this specimen with *A. pulchella* then, as pointed out in the discussion under *A. elegantula*, that species will have to be called *A. baumii*. However, in the description given by Knuth (l.c.) the calyx and corolla lobes are said to be acute and obtuse respectively, whereas both calyx and corolla lobes are acuminate in all of the specimens I have seen and cited under *A. elegantula*. As the latter species has several close relatives distinguished by such small (but apparently quite constant) differences I feel that *A. baumii* may indeed be distinct and in the absence of specimens prefer not to unite it with *A. elegantula*.

INDEX TO SPECIES, SUBSPECIES AND VARIETIES

Synonyms are italicized. Numbers show the position in the sequence adopted here. "In." indicates that the species (African or non-African) is mentioned in the introductory matter and the distribution table. Figures in brackets indicate that the species is mentioned in discussion under the species of that number.

A. acuminata Welw. ex Schinz 10, (11)
A. alternifolia Cav. In.
A. angustiloba (Engl. Engl. 5, 6)
A. arvensis L. 1, (12)
ssp. arvensis 1
var. *caerulea* Knuth 1
ssp. *phoenicea* (Scop.) Schinz et Keller 1
var. *phoenicea* 1 (12)
A. aberdarica Fries 4β
A. baumii Knuth end, (9)
A. bella Scott 4β
A. capensis Drège 1
A. centunculus Afzel. 14
A. churiensis Fries 5
A. crassifolia Thore In.
A. dekindtiana Gilg ex Knuth 9
A. djalonis Chev. 13γ
A. elegantula P. Tayl. 9 (8, 10)
A. filifolia Engl. et Gilg 8 (7, 9)
A. filiformis Cham. et Schlecht. In.
A. granvikii Fries 4β
A. hanningtonii Bak. 12
A. baumii Knuth end, (9)
A. hexamera P. Tayl. 6
A. huttonii Harv. 3
var. *nummularia* Harv. 3

A. iraruensis Fries 4β
A. keniensis Fries 4β
A. kigesiensis Good 5
A. kilimandscharica Knuth 4β
A. kingaënsis Engl. end
A. kochii Hess 7 (8)
A. linifolia L. In.
A. meyeri Schum. ex Knuth 4β
A. meyeri johannis (Engl.) Engl. 4β
A. micrantha Fries 4β
A. micropetala Poeppig ex Knuth 13α
A. monellii L. In.
A. minima (L.) Krause 14
A. nana Schinz 13α
A. natalensis Schltr. ex Knuth 12
A. nummulariifolia Bak. In.
A. ovalis Ruiz et Pav. 13
A. parviflora Hoffmg. et Link In.
A. platyphylla Baudo In.
A. pedunculata Salz. ex Duby 13α
A. peploides Bak. In.
A. phoenicea Scop. 1
A. pulchella Welw. ex Schinz 9
A. pulchella Salisb. 1 (9)
A. pumila Sw. 13 (14)
var. barbata P. Tayl. 13β
var. *compacta* St. Hil. et de Gir. 13α
var. djalonis (Chev.) P. Tayl. 13γ
var. *elongata* St. Hil. et de Gir. 13α
var. *linum-stellatum* St. Hil. et de Gir. 13α
var. *natalensis* (Schltr.) Knuth 12
var. *ovalis* (Ruiz et Pav.) Knuth 13α, (14)
var. *pedunculata* (Chod. et Hassl.) Knuth 13α
var. pumila 13α
var. *ruizii* St. Hil. et de Gir. 13α (14)
A. pusilla Salisb. 14
A. quartiniana (A. Rich.) Engl. 4α
var. *angustiloba* Engl. 5
var. *meyeri-johannis* Engl. 4β
A. rhodesiaca R. E. Fries 11
A. roberti Fries 4β
A. ruandensis Knuth et Mildbr. 5
A. rubricaulis Boj ex Duby In
A. schliebenii Knuth et Mildbr. 2
A. serpens Hochst. ex DC. 4α
ssp. serpens 4α
ssp. meyeri-johannis (Engl.) P. Tayl. 4β
A. sessilis Salzm. ex Duby 14
A. sp. end.
A. tenella L. In.
A. tenuicaulis Bak. 12 (5,13)
A. ulugurensis Knuth 5
Anagallidastrum exiguum Bub. 14
Centunculus indicus Royle 13α
C. mexicanus Schaffner ex Knuth 14
C. minimus L. 14
C. pentandrus R. Br. 13α
forma *longepedunculata* Chod. et Hassl. 13α
C. lanceolatus Mich x. 14
C. pumilus (Sw.) Kuntze 13α
C. simplex Hornem. 14
C. tenellus Duby 13α
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Micropyxis elongata Duby 13α
M. exigua (Bub.) Lunell 14
M. pumila (Sw.) Duby 13α
M. rubricaulis Duby In.
M. tenella Wight 13α

A.E.T.F.A.T. Index. This is an annual list issued by Association pour l'Etude Taxononique de la Flore d'Afrique Tropicale of what has been published on the taxonomic botany, in a wide sense, of Africa and Madagascar, mentioning new taxa of all ranks, new combinations, and revisions and papers of taxonomic interest.

The indexes for 1953 and 1954 are obtainable, price 11 - and 15 - respectively, post free, from Mr. A. A. Bullock, The Herbarium, Royal Botanic Gardens, Kew, Surrey.

J. P. M. Brenan.

A NEW SPECIES OF ELSINOE PARASITIC ON THE FRUITS OF A TERMINALIA.

DEREK A. REID

In February 1955 samples of diseased fruit of a species of *Terminalia*, believed to be *T. chebula* Retz. were examined at the request of a commercial firm. This firm imports 20,000 tons of the nuts annually from India for use in tanning leather.

The diseased fruit showed numerous, dark brown, circular, scab-like lesions up to 6 mm. in diameter, covered with minute pustules of two sizes.

Small strips of tissue from the lesions were sectioned on a freezing microtome. It was then seen that the two kinds of pustules were caused by the ascogenous and *Sphaceloma* stages, respectively, of a hitherto undescribed species of *Elsinoe*.

FIG. 1. *Elsinoe indica* Reid : A. & B. sections through ascomata × 325 ; C. thin-walled asci with spores and protoplasmic contents × 650 ; D. ascospores × 650 .

Elsinoe indica *Reid*, sp. nov.

Maculis fusco-brunneis, saepe confluentibus, usque ad 6 mm. diametro ornatis, in fructibus *Terminaliae* sp. nascitur : *ascomatibus* nigris, pulvinatis, rotundis vel irregularibus, 78–182μ latis, 50–60μ crassis ; *ascis* subglobosis vel ovatis 20–31·2 × 15·6–23·4μ ; *ascosporis* 3-septatis, 13–15·6 × 5–7μ ; *acervulis* rotundis vel irregularibus, 50–80μ latis, 23–26μ crassis ; *conidiis* minutissimis, 3–5 × 0·5μ.

INDIA : on the fruits of a species of *Terminalia*, believed to be *T. chebula* (Typus in Herb. Kew.).

In this species the ascomata are produced subepidermally and are covered by a black rind of fungus tissue up to 15μ thick. When mature, however, this rind and the overlying epidermis are ruptured to allow

spore discharge. The ascomata may contain as many as eight, probably more, subglobose asci. These are usually eight-spored, but four-spored asci also occur. The ascospores have three transverse septa but the second and less often the third cell may become longitudinally septate. The spores are usually somewhat constricted at the second septum. The acervuli of the *Sphaceloma* stage are easily distinguished from the ascomata by their smaller size. Conidiophores could not be seen with certainty, but there were numerous minute conidia present on and around the pustules. These conidia, when stained in aniline blue in lactic acid, showed two polar guttules.

Bitancourt (1937) described a species of *Sphaceloma* from Brazil, on leaves and fruits of *Terminalia catappa* Linn. which he named *S. terminaliae*. Bitancourt's fungus has since been recorded on *T. bellerica* Roxb. in India by Thirumalachar (1946) but it differs from the present species in having much larger conidia.

The author wishes to thank Mr. R. D. Meikle for assistance with the Latin diagnosis.

References :—

Bitancourt, A. (1937). Novas especies de Sphaceloma sobre Terminalia e Genipa. Arch. Inst. biol. Def. agric. anim., S. Paulo **8**, Art. 13, 197–200.

Thirumalachar, M. (1946). Doenças causadas por fungos dos gêneros ' Elsinoë ' e ' Sphaceloma ' em Misore. Arch. Inst. biol. Def. agric. anim., S. Paulo **17**, Art. 4, 55–66.

Agriculture in Kent.—The Royal Agricultural Society of England have published what was originally to be the first volume of a series eventually covering the whole country dealing with agriculture on a county or other regional basis. It is much to be hoped that the series can be completed on the standard set by this volume* on Kent. There is much in this book of interest not only to those directly linked with agriculture, but also to the geographer, the economist, the general reader, and even the botanist. The variety of soils derived from the Mesozoic, Cainozoic, and Recent rocks is one cause underlying the range of agricultural products in this county which, though only ninth in size of the counties of England and Wales, employs more agricultural workers than any other county. More than one-half of all the hops and one-quarter of all the fruit grown in the country is produced in Kent. The different methods of farming and the principal products are dealt with in a succession of chapters. Of special interest are those on grassland, hops, and fruit. There is a short chapter on forest and woodland. A bibliography of 140 items is provided.

W. B. Turrill.

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* A Survey of the Agriculture of Kent, by G. H. Garrad. Royal Agricultural Society of London, 16 Bedford Square, London, W.C.1, 1954. pp. 232, maps and plates. 21/- net.

SOME NEW PLANTS FROM GREECE.

W. B. Turrill

Silene goulimyi *Turrill ;* a *S. radicosa* Boiss. et Heldr. caulibus brevioribus, foliis utrinque dense pubescentibus, inflorescentiae ramis saepissime longioribus, petalis roseis differt.

Herba perennis, caespitosa, multo ramosa, ramis foliatis 2–4 cm. altis, ramis floriferis 5–20 cm. altis teretibus in parte inferiore indumento declinato instructis in parte superiore plus minusve viscidis. *Folia* basalia late spathulata, abrupte acute apiculata, 1–2 cm. longa, 4–8 mm. lata, utrinque dense breviter pubescentia, costa nervisque inconspicuis, basi in petiolum gradatim angustata ; folia caulina lanceolato-linearia vel linearia, acuta, 0·6–1·3 cm. longa, 1–1·5 mm. lata. *Inflorescentiae* 1–3-florae, ramis lateralibus usque ad 6 cm. longis. *Calyx* 11–12 mm. longus, glaber, 10-nervius, nervis in parte superiore valde anastomosantibus, dentibus erectis ovatis vel oblongo-ovatis acute apiculatis 2 mm. longis 1·5–1·75 mm. latis margine late membranaceis. *Petala* 1·7 cm. longa, glabra, lamina profunde bifida 6 mm. longa rosea. *Filamenta* tenuia, 1·5 cm. longa. *Ovarium* ellipsoideo-cylindricum, glabrum. *Capsula* 8 mm. longa (carpophorio 4–5 mm. longo excluso). *Semina* reniformia, 1 mm. longa, minute echinulata dorso praecipue.

Greece : Peloponnese, Mt. Taygetus, Langada Gorge, 17 May 1955, *C. N. Goulimy* (Holotypus in Herb. Kew.).

Early in April this year, Dr. C. N. Goulimy, who is doing much to add to our knowledge of the flora of Greece, sent to the writer a specimen of a *Silene* which could not be matched with any material at Kew. This specimen was collected on the eastern slopes of Mt. Taygetus in the gorge to the south of the villages Kastri and Georgitsi. Only two specimens were found, after a prolonged search, and both were growing on a dry rock though there was plenty of water around. A short time afterwards, in response to a request for additional material, Dr. Goulimy sent an excellent series of specimens in flower and in fruit collected in the Langada Gorge on 17 May 1955. A prolonged investigation failed to provide a name for what appears to be a new and distinct species.

The genus *Silene* is a large one in the flora of the Balkan Peninsula and morphological affinities are not easy to trace, partly because of reticulation of characters. In many respects *S. goulimyi* appears to be structurally similar to *S. radicosa* Boiss. et Heldr., which was originally described, in Boiss. Diagn. **1,** no, 6, p. 24 (1845), from " ad limites superiores tertiae regionis *Taygeti* loco *Agia Barbara* dicto de Heldreich Julio 1844 ". In Boiss. Diagn. **2,** no. 1, p. 75 (1853), Boissier described *Silene oligantha* as a new species from " in saxosis regionis sylvaticae Olympi *Thessaliae* (Heldreich) ", with a variety, *stenophylla*, from Mt. Malevo and Mt. Parnassus. In the Flora Orientalis, **1,** 645 (1867), Boissier reduced *S. oligantha* to a variety under the name var. *breviflora* and ignored his var. *stenophylla*. Halácsy, Consp. Fl. Graec. **1,** 179–80 (1900) maintained *S. radicosa* and *S. oligantha* as distinct species but Hayek, Prod. Fl. Penins. Balc. **1,** 279 (1924) again reduced the latter to a variety of *S. radicosa* using the varietal epithet *breviflora*.

For our present purpose we may contrast the material of the new *S. goulimyi* with *S. radicosa* in the broadest sense, so far as published descriptions and material at Kew are concerned. In range, *S. goulimyi* comes well within that of *S. radicosa* and, indeed, the *locus classicus* of the latter must be close to that of the former. Dr. Goulimy's two collectings of *S. gloulimyi* show a complete correlation of the characters considered to differentiate it from *S. radicosa*. On the other hand, there is some variation in *S. radicosa* which is probably in part correlated with genotypic differences. *S. goulimyi* has less stout stem bases or root-stocks than have specimens of *S. radicosa*, the flowering stems are shorter, and the side branches of the inflorescence, when present, are more elongated. The leaves in *S. goulimyi* are densely, if shortly, and equally pubescent over the whole of both surfaces and the indumentum is not, or even mainly, restricted to the margins and midrib, as it is in most specimens of *S. radicosa*. However, one has to note that in the material at Kew of *S. radicosa* var. *breviflora* (*S. oligantha*) the leaf pubescence in kind and surface distribution approximates to that of *S. goulimyi*. Though the calyx in both species under consideration here has ten main veins there are some differences. The calyces of *S. goulimyi* are not furrowed, the venation is slender, clear, and fairly flat, and the main veins have anastomosing branches in the upper part. Boissier, describes the laminae of the petals of *S. radicosa* as " flavidis ", those of *S. goulimyi* are recorded as " rose ". There is, however, on herbarium sheets of *S. radicosa* some range of petal colour recorded from " dirty green " to " pinkish mauve ".

Campanula goulimyi *Turrill* ; a *C. tubulosa* Lam. foliis caulinis saepe oblanceolatis, floribus minoribus distinguitur.

Herba perennis, caulibus usque ad 2·4 dm. longis teretibus tenuibus patule pubescentibus foliatis internodiis 5 11 cm. longis. *Folia* basalia spathulata, lamina apice rotundata basi in petiolum gradatim angustata, 1·5–4 cm. longa (petiolo 1–2·5 cm. longo incluso), utrinque pubescentia, margine integra vel leviter undulata ; caulina inferiora spathulata vel oblanceolato-spathulata, lamina usque ad 1·2 cm. lata ; superiora oblanceolata, apice rotundata, basi angustata sessilia, 1·5–3 cm. longa, 0·5–1·5 cm. lata ; suprema elliptica, 1–1·5 cm. longa, 0·4 0·7 cm. lata. *Flores* solitarii, terminales vel axillares, haud numerosi ; receptaculum obconicum, 6 mm. longum, 5 mm. diametro, dense breviter pubescens. *Sepala* (calycis laciniae) lanceolata, acuminata, 1·7 cm. longa, 0·6 cm. lata, utrinque pubescentia, reticulato-venosa ; appendices ovatae, acutae, 7 mm. longae, 4·5 mm. latae, utrinque dense pubescentes, valde reflexae. *Corolla* tubulosa, 2·2 cm. longa, tubo 5 mm. diametro, pubescens, caerulea, lobis ellipticis 6 mm. longis 4 mm. latis. *Filamenta* 3 mm. longa, plana, 1·5 mm. lata, apice abrupte angustata, leviter ciliata ; antherae dehiscentes lineares, apice brevissime apiculatae, 5·5 mm. longae. *Stylus* 1·3 cm. longus, basi dense pubescens, superne gradatim glabrescens ; stigmata 5 (interdum 4) ; ovarium 5-loculare.

Greece : Euboea : on rocks overhanging the road from Chalkis to Limni, about 60 km. from Chalkis, 28 May 1955, *C. N. Goulimy*. (Holotypus in Herb. Kew.).

The morphological relationship of this interesting plant appears to be with *Campanula tubulosa* Lam., a species which, so far as is known, is

limited in its natural range to Crete where it occurs widely in western and central districts from 100 to over 600 m. altitude. The flowers of *C. goulimyi* are more scattered than those of *C. tubulosa*, usually with longer internodes or branches separating one from another, and are much smaller.

Campanula rupestris *Sibth. et Sm.* var. **spathulifolia** *Turrill* ; a var. *rupestri* foliis spathulatis margine integris vel inconspicue crenulatis recedit.

Herba perennis. *Rhizoma* ramosum, saepe elongatum, sublignosum, squamis obtectum. *Caules* plus minusve prostrati, 4–12 cm. longi, incano-pubescentes. *Folia* basalia spathulata, haud lobata, apice obtusa vel subobtusa interdum breviter apiculata, basi gradatim elongato-angustata in petiolum indistinctum, 4·5–7·5 cm. longa (petiolo integro incluso), 0·5–1·0 cm. lata, margine integra vel indistincte crenulata, utrinque dense incano-pubescentia, juniora fere albo-tomentosa, costa nervisque in pagina adaxiale inconspicuis in pagina abaxiale leviter prominentibus ; folia caulina foliis basalibus subsimilia sed minora. *Racemus* 6–9-florus, incano-pubescens ; flores in bractearum axillis solitarii ; bracteae 4–8 mm. longae ; pedicelli 1–2 mm. longi ; receptaculum obconicum, circiter 3 mm. longum, dense tomentosum. *Sepala* lanceolata, acuta, 7 mm. longa, 3 mm. lata, in pagina abaxiale dense incano-pubescentia ; calycis tubus fere nullus ; appendices ovatae vel lanceolato-ovatae, acutae, 3 mm. longae, valde reflexae. *Corolla* caerulea, in pagina abaxiale incano-pubescens ; tubus 8–10 mm. longus, 4–5 mm. diametro ; lobi anguste elliptici, acuti, 4 mm. longi, 2 mm. lati. *Antherae* dehiscentes oblongo-lineares, apice breviter apiculatae, 5 mm. longae ; filamenta 2 mm. longa, plana, 1·75 mm. lata, margine ciliata. *Stylus* 8 mm. longus ; stigmata 5 ; ovarium 5-loculare.

Greece. Attica : on rocks overhanging the road from Athens to Thebes, close to Kaza, 50 km. from Athens, 27 May 1955, *C. N. Goulimy*. (Holotypus in Herb. Kew.).

Campanula rupestris was originally described in Sibth. & Sm. Prodr. Fl. Graec. **1,** 142 (1806) and again with a coloured figure in Fl. Graec. **3,** 10, t. 213 (1819). It is, in these works, stated to occur " In Boeotiae et Peloponnesi rupibus ". It is undoubtedly a variable species, the more so if it be accepted in the wide sense of Hayek, Prodr. Fl. Penins. Balc. **2,** 524–5 (1930) to include *C. andrewsii* DC., *C. celsii* DC., and *C. anchusaeflora* S. et S. However, the material described above is distinctive in the relatively long and narrow spathulate basal leaves with the margins entire except for very inconspicuous crenulations. It appears at first sight decidedly different from any other material of *C. rupestris* at Kew and in leaf shape rather more recalls *C. saxatilis* L. which has larger flowers and is known from Crete and Karpathos. Our present plant certainly appears to be perennial with sub-woody branched rhizomes and tufted leafy shoots. *C. rupestris* is stated by Halácsy and by Hayek to be biennial. There are, however, some sheets at Kew with basal shoots that may well carry on the individual to another year or more after first flowering.

It has to be noted that Halácsy in Oesterr. Bot. Zeitschr. **46,** 13 (1896) records under the name f. *gracilis* Heldr. a variant of *C. rupestris* " mit

spateligen, nur schwachgezähnelten Grundblättern ". In the Consp. Fl. Graec. **2,** 256 (1902) this is raised to the rank of a variety and a somewhat fuller Latin description is appended. The type of this, which apparently came from Mt. Cithaeron, Attica, has not been seen by the writer but the statement " folia minuta " does not apply to our plant.

Linaria hellenica *Turrill* ; a *L. simplici* (Willd.) DC. pedicellis longioribus seminibus haud membranaceo-marginatis valde differt.

Herba probabiliter annua, usque ad 4·6 dm. alta, caulibus plus minusve erectis a basi leviter ramosis teretibus glabris in parte inferiore foliatis internodiis 0·2–2 cm. longis. *Folia* linearia, apice basique leviter angustata, apice subobtusa vel rotundata, 1·5–3·7 cm. longa, 1–2 mm. lata, glabra, costa nervisque inconspicuis. *Racemi* laxi, elongati, usque ad 20-flori, in parte inferiore glabri vel fere glabri, in parte superiore pilis glandulosis dispersis instructi ; pedicellis floriferis 5–7 mm. longis, fructiferis usque ad 1·5 cm. longis, in parte superiore glanduloso-pubescentibus ; bracteae foliis similes sed breviores, altissimae 2–3 mm. longae. *Sepala* oblongo-linearia, subobtusa, subaequalia, 4·5–5 mm. longa, 1 mm. lata, viridia, margine membranacea, glanduloso-pubescentia. *Corolla* flavida, 8 mm. longa (calcari 7 mm. longo recto excluso), tubo 3·25 mm. longo, sparse glanduloso-pubescens. *Stamina* 4 mm. longa. *Ovarium* compressum, ambitu oblongo-ovatum, 1·75 mm. altum, 1·5 mm. latum, pilis sparsis praeditum ; stylus 3·5 mm. longus, glaber ; stigma brevissime bifidum. *Capsula* 5 mm. longa. *Semina* leviter compressa, ambitu hemispherica vel subreniformia, 0·75 mm. longa, valde rugosa, haud marginata.

Greece : Peloponnese, between Kambos and Neapolis, Cape Malea Peninsula, 18 May 1955, *C. N. Goulimy* (Holotypus in Herb. Kew.).

The " affinities " of this toadflax are difficult to determine. In habit and indumentum there is similarity to *Linaria simplex* (Willd.) DC. Indeed, the material keys down to *L. arvensis* (L.) Desf. and *L. parviflora* (Jacq.) Hal. in Hayek's Prod. Fl. Penins. Balc. **2,** 138–9 (1929). The name *L. parviflora* (Jacq.) Hal. is a later homonym (1902) of *L. parviflora* Desf. (1798) and has to give place to *L. simplex* (Willd.) DC. However, *L. simplex* has flat, discoid, seeds with a membranaceous margin. In *L. hellenica* the seeds are slightly flattened, somewhat irregular in shape, strongly rugose with many of the folds more or less transverse to the long axis of the seed, and with no trace of a winged margin. The mature seeds described were received in a separate packet but so far as can be ascertained from very immature seeds obtained from younger dried capsules on the type specimen, there is no reason to suppose there has been any mistake made in associating them with the type material which is in flower and young fruit.

The genus *Linaria* requires monographing by modern systematic methods. It may well be that great stress will then be laid on seed characters. Greek species of the genus with wingless seeds mostly have these with angular-triquetrous shape. *L. reflexa* with seeds oblong and emarginate is totally different in habit, leaf-shape, and other characters from *L. hellenica*.

There is a group of Spanish species within the section *Linariastrum* Chav. with emarginate apterous seeds grouped together by Willkomm & Lange, Prod. Fl. Hisp. **2**, 558 1870 . Of these *L. viscosa* L. Dum. Cours. appears to come nearest to *L. hellenica* both in its glandular indumentum and in its seed characters. It has, however, more compact inflorescences and infructescences and larger corollas.

The genus Nicotiana*.—Before the discovery and invasion of America by Europeans, our ancestors existed, more or less miserably, without the potato, maize, quinine, and tobacco. To the botanist, the genus *Nicotiana* has interests other than the narcotic properties of the products manufactured from some of its species. No doubt attention has been particularly drawn to it because of the commercial value of tobacco crops but cytologists, geneticists, taxonomists, and horticulturists have found in it favourable material for research. Most of this has been published in large numbers of papers in many different journals. One therefore welcomes Professor Goodspeed's authoritative account of the sixty species he recognizes as comprising the genus *Nicotiana* and of which he grew under controlled conditions all but four.

The book is divided into six parts, dealing respectively with distribution, morphology, cytology of species, cytology of F_1 interspecific hybrids, phylesis, and taxonomy. Seventy-five per cent. of the species occur in the Americas and twenty-five per cent. in Australia and some South Pacific islands. The ranges of the subgenera, sections, and species are considered in detail and, combined with cytogenetical and taxonomic facts, throw much light on the probable history and evolution of the genus. All the fifteen Australasian species are members of the section *Suaveolentes*, subgenus *Petunioides*. The generic range favours a previous connection between South America and Australia via Antarctica. As full a knowledge as possible of the morphology of all parts, vegetative and reproductive, of the constituent species of such a genus as *Nicotiana* is essential as a preliminary to cytogenetical studies if these are to be understood and interpreted in broader terms than those of limited karyology. Both gross morphology and anatomy here receive the attention they deserve.

The cytological investigation of *Nicotiana* has been extensive and intensive. Professor Goodspeed himself has been a leader in this research. For many years he made determinations of chromosomes from " root tips or other vegetative tissues and or of MI and MII in PMC. Recently, the first division in the microspore has been studied in detail in all but seven of the species recognized." This quotation gives some indication of the thoroughness characteristic of this monograph. There is considerable variation in the cytology of the species. Haploidy has been frequently observed ; autoploidy can be readily induced by a variety of treatments ; and aneuploidy has been reported in certain species. Evidence is given in favour of 6 being the basic chromosome number of

the genus. The chromosomes are relatively small but karyotypes have been worked out for most of the species and are given in a series of text figures. The cytology of reproduction is illustrated by a series of instructive and clear plates. Euploidy, aneuploidy, and amphiploidy are considered in detail since their importance is considerable in evolution within the genus in which " ploidy " of one kind or another is widespread. Pairing and behaviour in the first meiotic division are treated at length.

In part 5, the factual evidence presented earlier is interpreted in terms of species origins, relationships, and evolution. While 6 may well have been the original basic number for the genus *Nicotiana*, and for its family, the *Solanaceae*, " with the doubtful exception of a species of *Capsicum* there are today no 6-paired species in the *Solanaceae* ". It might be safer to add " as so far cytologically studied and the results published ". Anyhow, ploidy has resulted especially in 12-paired and 24-paired levels. Amphiploidy superimposed on amphiploidy is, it is concluded, " the basic evolutionary process responsible for the 6–12–24 paired sequence in the genus ". Autoploidy has apparently been insignificant. The importance of hybridization in evolution has, however, not been limited to amphiploidy since hybridization without chromosome doubling has acted both in the origin of sections and in speciation. The evolutionary effectiveness of mutations is unquestioned. Mutation has provided the material basis to variability at any taxonomic level. However, " The effect of mutation in process on any given level is difficult to document since it is not readily distinguishable from that of segregation of gene differences accumulated on an earlier level nor from that of chromosome alteration which can be demonstrated to occur ".

The final part is an excellent account by Professor Goodspeed, Helen Max-Wheeler, and Paul C. Hutchison, of the taxonomy of *Nicotiana*. This gives concise descriptions, keys, references, synonyms, ranges, and comments under the sixty species taxonomically classified into subgenera and sections. Black-and-white text illustrations supplement the descriptions. A bibliography of literature cited and an adequate index are provided.

From the brief summary here given of the ground covered by this book it should be evident that it deserves study by every botanist interested in evolutionary problems. To those who envisage an increasing importance for synthetic taxonomy it justifies optimism. Those who continue to doubt whether taxonomy can be so extended as to include such a wealth of new data as here presented will either have to ignore it or they will have to wangle out of a difficult position. It is probably too much to expect them to change their views.

In addition to welcoming this book as a marked contribution to modern synthetic taxonomy and congratulating the author on its contents, a word of appreciation must be given to the Chronica Botanica Company for its publication. It is understood that copies can be obtained in this country from Wm. Dawson and Sons, Ltd., Cannon House, Macklin Street, London, W.C.2.

W. B. TURRILL.

* The Genus Nicotiana, by Thomas Harper Goodspeed, Chronica Botanica 16, Number 1/6, Waltham, Mass., U.S.A. 1954, pp. 536. 12·50 dollars.

TWO PROPOSED NEW GENERA OF HELOTIALES.

R. W. G. Dennis

Nearly sixty years ago Bresadola described under the name *Patinella coracina* a curious blackish discomycete found on wet rotting wood in north Italy. In referring his species to *Patinella* he was following the artificial system of discomycete classification popularised by Saccardo and still perpetuated in Clements and Shear's well-known keys to fungus genera, in which small dark-coloured apothecia fall in Patellariaceae and superficial lignicolous species with 8 simple hyaline spores per ascus are referred to *Patinella*. But *Patinella* Sacc. originated as a monotypic genus based on *P. hyalophaea* Sacc. which Nannfeldt has shown to belong to the Orbiliaceae, whereas Bresadola's fungus is certainly not orbiliaceous. *Psilothecium* Clements 1903, proposed for a discomycete apparently somewhat similar to *P. coracina*, is a later homonym of *Psilothecium* Fuckel, 1865. Nannfeldt (1932) studied *Patinella coracina* Bres. and concluded that it " mit der Gattung *Catinella* ziemlich grosse Verwandtschaft zeigt. Sie reprasentiert wahrscheinlich eine noch unbeschriebene Gattung."

Among Charles Crossland's notes and drawings at Kew are details of a collection sent him by J. Needham, on dead twigs in a moist place, Crimsworth Dean, Hebden Bridge, 13.2.1898, which seems to have been Bresadola's fungus. Unfortunately Crossland lost the material and left the species undetermined apart from an uncertain reference to *Patellea stygia* (Berk. & Curt.) Sacc. which is a *Karschia* and bears little resemblance either to Crossland's careful drawings or to Bresadola's description. Recently Mr. W. D. Graddon has rediscovered what appears to be *P. coracina* Bres., again in Yorkshire but this time on fallen twigs of *Prunus laurocerasus*. As will be seen, the spores ultimately become 1-septate so that under Saccardo's system the species might be sought in *Patellea* (Fr.) Sacc. That genus, however, was founded on *Durella commutata* Fuck., a fungus with small asci and an excipulum of " textura oblita ".

Nannfeldt was certainly correct in drawing attention to the structural resemblance between *Patinella coracina* Bres. and *Catinella olivacea* (Batsch ex Fr.) Boud. but these two species differ considerably in spore characters and can hardly be congeneric. It seems necessary to follow Nannfeldt's suggestion and to propose a new genus with *Patinella coracina* Bres. as the type species. For this I propose the name *Graddonia* in honour of Mr. W. D. Graddon whose patient collecting has contributed so many interesting species to the known British fungus flora.

1. **Graddonia** *Dennis*, gen. nov. Ascomatibus sessilibus, superficialibus, patellaribus, orbicularibus, fuscis vel nigris ; excipulo crasso, fusco, parenchymatico ; ascis cylindraceis, tenui-tunicatis, apice rotundatis, jodi non tinctis ; sporidiis ellipsoideis, hyalinis, 0-1 septatis ; paraphysibus filiformibus.

Graddonia coracina (*Bres.*) *Dennis*, comb. nov.

Patinella coracina Bres. in Malpighia **2,** 278 (1897).

Apothecia gregarious, up to 1·5 mm. across, saucer-shaped, sessile on a broad base, disc flat, immarginate, fawn-grey to purplish, externally

smooth, dark chocolate-brown to blackish, drying black throughout. Flesh thick, formed of slender woven hyphae ; excipulum about 60μ thick, of thinwalled, light-coloured, prismatic cells, about 10–15 × 7–10μ, arranged in rows at a high angle to the surface, the superficial cells dark-brown, isodiametric, 6–8μ diameter. Asci cylindrico-clavate, 150–170 × 11–13μ, thinwalled, apex obtuse, not blued by Melzer's reagent, 8-spored ; ascospores obliquely uniseriate, elliptic-fusiform, 18–24 × 7–9μ, hyaline, at first continuous and multiguttulate, tending to become 1-septate, seldom 2-septate ; paraphyses cylindrical, slightly enlarged to 3μ at the rounded tip.

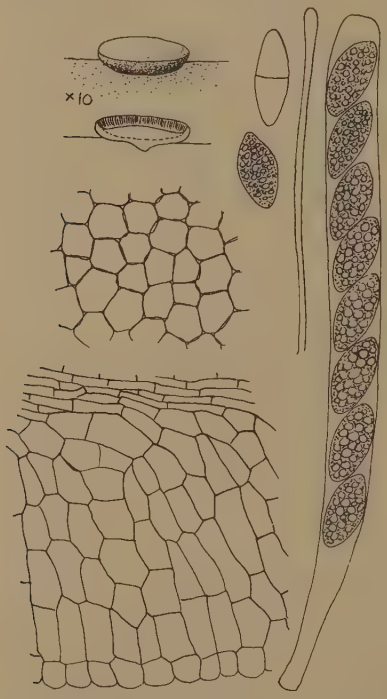

Fig. 1. *Graddonia coracina*. Habit sketch and vertical section × 10, excipular cells in surface view and radial section, ascus, paraphysis and free spores × 660.

British collection seen : On fallen twigs of *Prunus laurocerasus*, Grantley Hall, near Ripon, Yorkshire, April 1954, *W. D. Graddon* 876.

These large, rather thinwalled asci, without a distinct apical pore, are reminiscent of the Pezizales, as are also the large, elliptical, uniseriate spores. I have been unable, however, to observe operculate dehiscence and septation of the mature ascospores is a character almost unknown in the Pezizales. If operculate dehiscence of the asci were demonstrated *Graddonia* would obviously fall in the neighbourhood of *Ascophanus* ; in its absence the affinities of the genus appear to lie with the Dermateaceae.

2. **Phaeangellina** *Dennis*, gen. nov.

Ascomata subgelatinosa, sicca subcornea, sessilia, globoso-turbinata, glabra, erumpenti-superficialia, purpureo-brunnea vel atra, excipulo

fibroso. Asci clavati, octospori. Sporidia elliptica, fuliginea, uniseptata. Paraphyses filiformes. Monotypus : *Cenangium empetri* Phill.

Phaeangellina empetri (*Phill.*) *Dennis* comb. nov.

Cenangium empetri Phill. in Scott. Nat. N.S. **5,** 89 (1891).

Pseudophacidium smithianum Boud. in Trans. Brit. mycol. Soc. **3,** 81 (1909)

Phaeangella smithiana (Boud.) Boud. in Naturalist, 206 (1912).

Phaeangella empetri (Phill.) Boud. in Trans. Brit. mycol. Soc. **4,** 74 (1913).

Phaeopezia empetri Rostr. in Bot. Tidsskr. **25,** 317 (1903).

Aleurina empetri (Rostr.) Sacc. & D. Sacc., Syll. Fung. **18,** 90 (1906).

FIG. 2. Section of apothecial margin in *Phaeangellina empetri* × 660.

Thus this very common discomycete on dead *Empetrum* leaves has been referred to at least five genera and unfortunately it seems out of place in any of them. *Phæopezia* Sacc. and *Aleurina* Sacc. & Syd. are genera of Pezizales and as such are in appropriate for any fungus with inoperculate asci. *Cenangium* Fr., as typified by *C. ferruginosum* Fr., has hyaline ascospores, as does *Pseudophacidium* Karst. *Phaeangella* (Sacc.) Massee has as lectotype *Dermatea ulicis* Cooke, a species with pseudoparenchymatous excipulum, quite unlike *P. empetri.* Other discomycetous genera with brown uniseptate ascospores are *Dermatella* Karst., which is Dermateaceous and *Phaeohelotium* Kanouse, described as having the excipulum formed of large thinwalled cells. The *Empetrum* fungus cannot be

assigned to either of these but it does bear marked structural resemblance to species of *Chloroscypha* Seaver. These also have minute, dark, subgelatinous apothecia, erumpent from leaves, similar excipular structure and very similar asci. All the known species of *Chloroscypha*, however, occur on conifers and have hyaline spores, though in *C. cedrina* (Cooke) Seaver these may be tardily 1-septate like those of *P. empetri*. As at present circumscribed *Chloroscypha* seems a very natural genus and one is reluctantly forced to conclude that its emendation to embrace *P. empetri* would be an unjustifiable step. Seaver drew attention to some resemblance between the hymenium of a *Chloroscypha* and that of an *Ascobolus*. Superficially the resemblance is enhanced by the presence of brown ascospores in *Phaeangellina* but the pigment in the latter appears to be within the spore and is not deposited as a detachable epispore like that in *Ascobolus*. The excipular structure is also quite unlike that of the Ascobolaceae and septation of the spores is not a character of the Pezizales. There is no visible pore at the apex of the ascus in *P. empetri*, nor does a pore plug stain with iodine. Nevertheless its asci have always been regarded as inoperculate and until they can be demonstrated to be other- *Phaeangellina* will find its place beside *Chloroscypha* in the Helotiaceae.

The Wild Flowers of Kuwait and Bahrain.*—Over a period of several years the author has made representative collections of the plants growing in Kuwait and neighbouring parts of Arabia, and the list now published is the most complete for the flora of the area. The species are recorded in alphabetical order, each under its Latin name, and usually with the native equivalent, which is also given in a separate index, inserted alongside ; there follows a brief description of the most distinctive features of the plant in the field, and the locality where it was found. The list includes a new monotypic genus of Cruciferae, endemic in Kuwait, and other species which have not been previously collected from this region. There are 4 maps and a series of black and white drawings, 2 coloured illustrations and 5 photographs. One of the maps shows the distribution of the main vegetation zones and the author gives some simple details of the natural and cultivated vegetation and of the climate. In addition there are the first published records of the marine Algae of Kuwait and Bahrain and comments on the Fungi of Kuwait. A short account of the flora of the Bahrain archipelago, together with two maps and a list of species, has been contributed by Professor R. O. Good.

Although a critical taxonomic revision of Mrs. Dickinson's specimens is still being carried out at Kew, the present work should provide an interesting and useful source of information for those studying the wild flowers of Kuwait and adjoining areas of Arabia.

P. Lewis.

* The Wild Flowers of Kuwait and Bahrain, by Violet Dickson, M.B.E., F.Z.S. London: George Allen & Unwin Ltd., 1955. Price 25/-.

FUNGI FROM SIERRA LEONE : PEZIZALES AND HELOTIALES

R. W. G. Dennis

The following Discomycetes are among numerous mycological collections presented to Kew by Mr. F. C. Deighton, plant pathologist in Sierra Leone from 1926 to 1954.

PEZIZALES

Sarcoscyphaceae

Cookeina *O. Kuntze*, Rev. Gen. Pl. **2,** 849 (1891).

Cookeina tricholoma (*Mont.*) *O. Kuntze*, Rev. Gen. Pl. **2,** 849 (1891).

Peziza tricholoma Mont. in Ann. Sci. Nat. Bot. Ser. **2,** 2, 77 (1834).

On dead twigs of *Macaranga huraefolia*, Sembehun (Bumpe), 19.X.54, *Deighton* M 6270.

Cookeina sulcipes (*Berk.*) *O. Kuntze*, Rev. Gen. Pl. **2,** 849 (1891).

Peziza sulcipes Berk. in London. Journ. Bot. **1,** 141 (1842).

On dead trunks of *Mangifera indica*, *Deighton* M 5379 ; *Anthocleista vogelii*, Deighton M 5380, both from Mosongo (Kori), 21.VIII.53 ; *Albizzia zygia*, Njala (Kori), 17.VI.54, Deighton M 5998. Previously received from Kanya, Sierra Leone, 8.X.1914, as *N. W. Thomas* 3063.

Phillipsia *Berk.* in J. Linn. Soc. Bot. **18,** 388 (1881).

Phillipsia domingensis (*Berk.*) *Berk.* in J. Linn. Soc. Bot. **18,** 388 (1881).

Peziza domingensis Berk. in Ann. Mag. Nat. Hist. Ser. 2, **9,** 201 (1852).

On dead burnt part of trunk of *Cassia siamea*, Njala (Kori), 15.IX.51, *Deighton* M 4249 ; on dead branches of *Cinnamomum zeylanicum*, Njala (Kori) 8.VII.54, M 6112 ; on dead branches of *Leptoderris fasciculata*, Gbesebu (Kamagai) ; 23.VII.54 *Deighton* M 6116.

HELOTIALES

Geoglossaceae

Trichoglossum *Boud.* in Bull. Soc. Myc. France **1,** 110 (1885).

Trichoglossum hirsutum (*Pers. ex Fr.*) *Boud.*, Hist. Class. Discom. Europe, 86 (1907).

Geoglossum hirsutum Pers. ex Fr. Syst. Myc. **1,** 488 (1821).

On the ground among roots of *Hevea brasiliensis* near Blama (Small Bo), 24.X.49, *Deighton* M 3236 ; on ground in *Hevea brasiliensis* plantation, Njala (Kori), 17.VI.54, *Deighton* M 6002.

HELOTIACEAE

Encoelia (*Fr.*) *Karst.*, Myc. Fenn. **1,** 18 (1871).

Encoelia russa (*Berk.* & *Br.*) *Dennis*, comb. nov.

Peziza (*Encoelium*) *russa* Berk. & Br. in J. Linn. Soc. Bot. **14,** 105 (1873).

Cenangium russum (Berk. & Br.) Sacc. Syll. Fung. **8,** 567 (1889).

Apothecia scattered or in small groups, disc up to 6 mm. across, fuscous to bone brown (Ridgway), concave when dry, flat when soaked up ; receptacle cupshaped, sessile, pruinose to scurfy, ochraceous-tawny to ochraceous-orange (Ridgway) ; flesh fibrous, pale ochraceous-salmon, formed of rather loosely woven, almost hyaline hyphae, 2–3μ wide ; excipulum ochraceous, 25–50μ thick, composed of isodiametric cells 7–9μ wide, with thin brown walls, the outer layers cracking apart to form the pruinose surface ; asci clavate, stipitate, 40–45 × 4–5μ, 8-spored, apex rounded, not blued by Melzer's reagent ; ascospores cylindrical with rounded ends or slightly allantoid, hyaline, continuous, 7–8·5 × 1·5–2μ ; paraphyses cylindrical with rounded tips, 1·5–2 μ wide. The tissue yields no coloured solution with KOH.

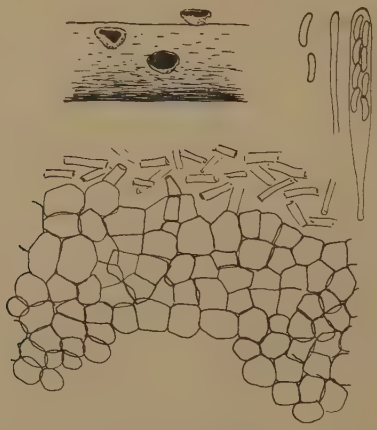

FIG. 1. *Encoelia russa*. Habit sketch natural size, section of excipulum, ascus, paraphysis and spores × 660.

On dead branches of *Rauwolfia vomitoria*, 18.VII.49, *Deighton* M 2955 ; of *Taraktogenus kurzii*, 22.X.52, *Deighton* M 4890 ; of *Phyllanthus discoideus* 13.VIII.49, *Deighton* M 2950 and 13.IX.49, *Deighton* M 3115C ; and of *Cassia siamea*, 17.XI.52, *Deighton* M 4970, all from Njala (Kori).

The type collection, from Central Province, Ceylon, Dec. 1868, differs only in showing slightly longer asci, 47–53 × 4–5μ.

Encoelia deightoni *Dennis* spec. nov. Ascomatibus gregariis, cortice erumpentibus, disco applanato, umbrino (burnt umber, Ridgway), subpruinoso, basim versus attenuatis, stipitatis, extus cinnamomeis, pruinosis, 1–4 mm. latis ; carne alba, in centro violacea ; excipulo grosse celluloso-parenchymatico ; ascis clavatis, apice rotundatis, octosporis, 60–66 × 5μ, jodo immutatis, paraphysibus filiformibus, hyalinis, 2μ crassis, interdum furcatis, intermixtis ; sporidiis monostichis, ellipsoideis, rectis, continuis, biguttulatis, hyalinis, 5–6 × 2μ.

Hab. in ramulis siccis Phyllanthi discoidei, prope Njala (Kori), Sierra Leone, 6.IX.1954, *Deighton* M 6201, Typus.

The purple colour of the flesh is located in the hyphae, not as a crystalline or amorphous deposit between them, and does not diffuse into water, KOH solution or lacto-phenol though the last named turns the coloured area a somewhat reddish hue.

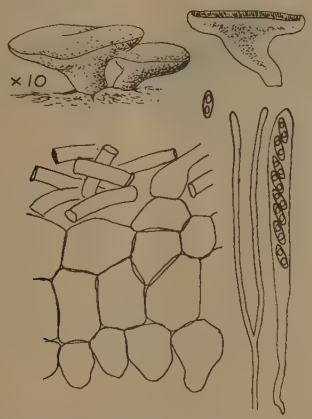

Fig. 2. *Encoelia deightoni*. Habit sketch and section × 10, section of excipulum ascus, paraphyses and spore × 660. The stippled area in the section indicates the extent of the violet coloured flesh.

Deighton M 6201 seems to form one of a group of tropical Helotiaceae characterised by their thin, soft, parenchymatous excipulum, relatively thick flesh of woven hyphae, small asci less than 70μ long with pore negative to iodine, small elliptical not reniform spores and slender unthickened paraphyses. To this group belong *Helotium cecropiae* P. Henn., *H. phlebophorum* Pat., *Phialea microspora* Seaver and *Helotium lobatum* Starb. which has already been transferred to *Encoelia* (Dennis 1954). The group differs from the typical section of *Encoelia* in having a flat or convex disc and well defined stalk and may ultimately prove worth generic rank. A possible alternative disposition for it would be in *Phaeangella* Massee, a genus founded to contain three species, two of which belong in *Dermea*. The third, *P. ulicis* (Cooke) Massee, was referred by Nannfeldt to *Encoelia* but if that is not accepted it may be taken as lectotype of *Phaeangella*. *P. ulicis* in many ways resembles the group of species listed above but its flesh yields a bright crimson solution in KOH, which suggests affinity rather with *Ionomidotis* Durand. In anatomy, in its

small asci with biguttulate spores and in its slender branched paraphyses *E. deightoni* also resembles species of *Chlorociboria* but it seems best, at least for the present, to restrict that genus to fungi containing a green pigment.

Cordierites *Mont.* in Ann. Sci. Nat. Ser. 2, **14,** 330 (1840).

Cordierites guyanensis *Mont.* op. cit. p. 331.

On dead trunk of *Mangifera indica*, Njala (Kori), 3.XI.54, *Deighton* M 6279.

The above is thought to be the first African collection of this well-known tropical American species. It has, however, been reported from Java and Sumatra by Boedijn (1936), whose collections apparently differed from the type in their larger size, thicker paraphyses and eguttulate ascospores.

Fig. 3. *Cordierites guyanensis* from Njala. Sketch of a fruiting branch × 10, ascus and paraphysis × 660.

Hyaloscyphaceae

Unguiculella *von Höhnel* in Sitz., N. Akad. Wiss. Wien, Math.-nat. Kl. Abt. I, **115**, 281 (1906).

Unguiculella meliolicola spec. nov. Ascomatibus minutis, 200–300μ diam., sparsis, ex hyphis ramosis, septatis, brunneis 2–3μ latis contexto sessilibus, siccis subsphaeroideis, albopuberulis, udis apertis et discum ostendentibus, extus et praecipue ad marginem pilosis, pilis sursum subulatis, hamatis, hyalinis, 15–20 × 1·5–3μ ; excipulo texturo prismatico, brunneo ; ascis clavatis, apice rotundatis, sessilis, 25–35 × 5-6μ, octosporis, jodo immutatis ; sporidiis distichis, oblongis, rectis, biguttulatis, 5–7 × 1–1·5μ ; paraphysibus hamatibus, 1–2μ crassis.

Hab. parasitica in mycelio *Meliolae sorindeiae* ad folia *Sorindeiae juglandifoliae*, Mosongo, Sierra Leone, *Deighton* M 5366C, Typus.

An earlier very scanty collection on an unnamed *Meliola* on *Glyphaea lateriflora* from the Gold Coast, 19.V.1949, S. J. Hughes 765, was briefly described by Dennis (1952).

Unguiculella caespitosa *Dennis* in Kew Bull. 1950, 170 (1950).

On dead twigs of *Theobroma cacao*, Njala (Kori), 4.X.49, *Deighton* M 3179F

Fig. 4. *Unguiculella meliolicola.* Radial section × 660.

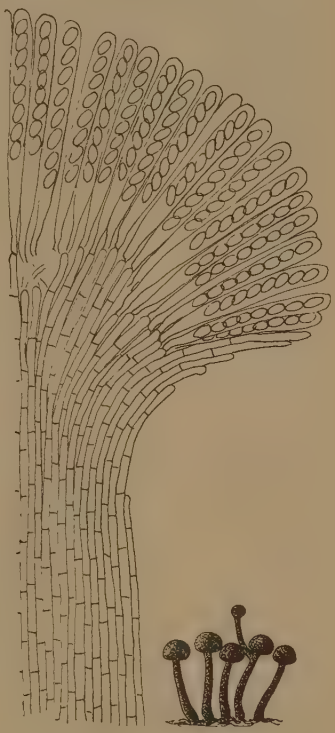

Fig. 5. *Sphinctrinella brasiliana.* Habit sketch × 10, section of apothecial margin × 660.

Caliciaceae

Sphinctrinella *Nádvorník* in Ann. Mycol. **40,** 138 (1942).

Sphinctrinella brasiliana (*Viegas*) *Dennis*, comb. nov.

Roesleria brásiliana Viegas in Bragantia **7,** 34 (1947).

Apothecia densely gregarious, black throughout, apothecium 200–400μ diameter, hemispherical, immarginate, seated on a slender smooth stalk, up to 2 mm. long × 100–200μ wide, stalk sometimes branched just below the apothecium, excipulum of slender, parallel, dark-brown hyphae, in direct continuation with those of the stalk. Asci cylindric-clavate, 60–70 × 5μ, apex rounded, not blued by Melzer's reagent, 8-spored ; ascospores uniseriate, biguttulate, brown, elliptical, 6–7 × 3μ, paraphyses not seen.

On bark of *Lannea afzelii*, Njala, 16.6.1953, *Deighton* M 5281.

The genus *Roesleria* Thum. & Pass. was founded on *R. hypogaea* Thum. & Pass., found on vine roots one to two metres below the soil surface. The type species was subsequently identified with the earlier *Coniocybe pallida* Fr. It has asci which become diffluent at maturity, leaving a globose head of loose spores, permeated and held together by long hyaline hyphae radiating from the top of the stalk. It is doubtful if a fungus with firm-walled persistent asci can justly be regarded as a *Roesleria* and it is accordingly proposed to transfer *R. brasiliana* to the genus *Sphinctrinella* Nádvorník. The type collection of *R. brasiliana* was from Minas Geraes, Brasil, on bark of *Spondias lutea*, belonging to the same family, Anacardiaceae, as the host of the Sierra Leone collection. Dr. Viegas has most kindly confirmed the determination of the latter by comparison with the type.

PHACIDIACEAE

Naemacyclus *Fuck.* in Jahrb. Nassauischen Ver. f. Naturk. **27/28,** 49 (1873).

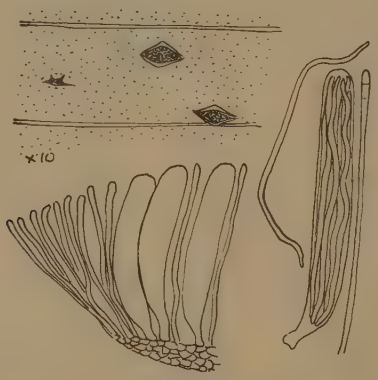

FIG. 6. *Nemacyclus penniseti.* Habit sketch × 10. Radial section, ascus, paraphysis and spore × 660.

Naemacyclus penniseti *Dennis*, spec. nov. Ascomatibus sub epidermide immersis, ellipsoideis, sparsis, per epidermidem longitudinaliter et irregulariter disrupta disco pallido plano emergentibus ; ascis cylindraceo clavatis, 50–60 × 7μ, apice abrupte rotundatis, octosporis, poro I– ; paraphysibus filiformibus, hyalinis, sursum tenuiter inflatis 1·5μ crassis ; sporidiis parallelis, filiformibus, undulatis, hyalinis, 70 × 1μ.

Hab. in foliis Penniseti leonis, Makondi (Kori), 4.I.54, *Deighton* 5509A. Typus.

This fungus bears a striking resemblance to the Cuban species *Naemacyclus macularis* (Berk. et Curt.) Sacc., from which it differs in its simple paraphyses and in growing on a grass instead of on *Cyperus* sp.

Boedijn, K. B. (1936) Bull. Jard. Bot. Buitenzorg, Ser. 3, 13, 525–529.
Dennis, R. W. G. (1952) Kew Bull. 1952, 324.
Dennis, R. W. G. (1954) Kew Bull. 1954, 289–348.

Ustilago salvei on Agrostis in England.

Ainsworth & Sampson (1950) cited species of *Arrhenatherum*, *Dactylis*, *Deschampsia*, *Festuca*, *Holcus*, *Lolium*, *Phalaris*, *Phleum* and *Poa* as hosts of the common leaf smut *Ustilago salvei* Berk. & Br. in the British Isles. In Europe it has been reported also, usually under the name *Tilletia striaeformis* (Westend.) Sacc., on species of *Agropyron*, *Agrostis*, *Alopecurus*, *Ammophila*, *Anthoxanthum*, *Brachypodium*, *Briza*, *Bromus*, *Calamagrostis*, *Helictotrichon*, *Milium* and *Phleum*. An *Ustilago* forming sori in the leaves of *Agropyron*, *Bromus* and *Calamagrostis* does occur in Britain but has been distinguished by Ainsworth & Sampson under the name *U. macrospora* Desm. There remains, however, a large number of common British grasses on which races of *U. salvei* might be expected to occur and it is now possible to report the presence of one of these, on *Agrostis stolonifera* L. var. *stolonifera*, Richmond, Surrey, 5 June, 1955.

Davis (1935) showed that the races of *U. salvei* on *Phleum pratense*, *Agrostis palustris*, *Poa pratensis*, *Poa annua* and *Dactylis glomerata* in North America were not cross-inoculable and proposed for the *Agrostis* race the name *U. striaeformis* f. *agrostidis*. This was raised to specific rank by Ciferri (1931) as *U. agrostis-palustris* (Davis) Cif., on biometrical grounds, but all subsequent authors have agreed that no constant morphological differences can be traced between the leaf-inhabiting *Ustilago* on *Agrostis*, spp. and that on *Holcus lanatus* L., the type host of *U. salvei*.

It should be noted that the other common and macroscopically indistinguishable stripe smut of grasses, *Urocystis agropyri* (Preuss) Schroet., also occurs occasionally on *Agrostis alba* in North America and on *A. vulgaris* in Norway.

Ainsworth, G. C. & Sampson, K. 1950. The British Smut Fungi. Kew, 137 pp.

Ciferri, R. 1931. Ann. mycol. 29 pp. 54–55.

Davis, W. H. 1935. Phytopathology, 25 pp. 810–817.

R. W. G. Dennis.

Natural Rock Gardening.*—This is something out of the ordinary run of books about rock gardens, for it is addressed to those who are fortunate enough to possess land with outcrops of rock. How such areas can be judiciously altered, planted with selected shrubs and herbs, and moulded into a rock garden is carefully explained by the author. Owners of property in the hill districts of this country will find much to interest them in this small book. There are fifty-five plates and thirty-eight line drawings, which probably accounts for the somewhat high price.

There is an index which could, with advantage, have been greatly expanded.

* Natural Rock Gardening by B. H. B. Symons-Jeune. Country Life Ltd., London. Price £1-10-0.

A new name in Senecio.

Senecio lamarckianus *Bullock*, nom. nov.

Conyza appendiculata Lam. Encycl. **2,** 88 (1786).

Synarthrum appendiculatum (Lam.) Cass. in Dict. Sc. Nat. **51,** 457 (1827).

Senecio appendiculatus (Lam.) DC. Prodr. **6,** 376 (1838), non Poir. Encycl. **7,** 102 (1806) ; Baker, Fl. Maurit. and Seych. 178 (1877).

Although Poiret's (1806) name *Senecio appendiculatus* represents an apparently illegitimate name-change for Vahl's earlier *S. auriculatus* (an Arabian plant), it was validly published and renders De Candolle's (1838) combination illegitimate as a later homonym. The Mauritius plant therefore requires a new name. The type-specimen is in Desfontaine's herbarium (Paris) and was collected in Mauritius by Commerson.

A. A. Bullock.

Tropical Fruits.*—In view of the increasing interest in tropical fruits and their production the appearance of this comprehensive work will be welcomed by many. Although it has been written primarily for Indian readers it contains a great deal of information that will be useful to fruit growers or anyone interested in tropical fruits in other parts of the world. The authors have had long experience of fruit production under Indian conditions and deal with their subject in an able and practical manner.

The following fruits are dealt with, a separate chapter and bibliography being devoted to each—banana, mango, citrus, guava, pomegranate, pawpaw, grape, sapodilla, fig and jujube or ber. It is understandable that some eighty pages should be allocated to the mango which is such an important fruit throughout the Indian Sub-continent, over three million tons being produced annually in Uttar Pradesh (United Provinces) alone, according to the authors. The citrus fruits and bananas are also dealt with at great length. India produces excellent guavas in some districts, canned guavas from India or Pakistan being now on sale in the United Kingdom. The high vitamin content of this fruit, established during the second world war, attracted much attention. What the authors have to say about the guava in India, particularly the new varieties or selections that have been produced there, should be of interest to many horticulturalists in the tropics and sub-tropics.

A few of the well known fruits of warm climates are not dealt with in the book, presumably because they are not regarded by the authors as commercially important in India at the present time. Examples are the pineapple, litchi, avocado pear, custard apple (or other Annonaceous fruits) and the passion fruits.

F. N. Howes.

* Commercial Fruits of India—with special reference to Western India. By G. S. Cheema, S. S. Bhat and K. C. Naik. Pp. x + 422. Illus. 46. (Macmillan & Co., London, 1954. Price 30/-).

CONTRIBUTIONS TO THE FLORA OF TROPICAL AMERICA : LIX*.

Two new species from British Guiana.

N. Y. Sandwith

Violaceae

Rinorea neglecta *Sandwith*, sp. nov. ; *R. pubiflorae* (Benth.) Sprague et Sandwith, *R. falcatae* (Mart. ex Eichl.) Kze. atque *R. camptoneurae* (Radlk.) Melchior affinis, ab omnibus foliis basi conspicue auriculiformi-cordatulis statim distinguitur ; praeterea a *R. pubiflora* petalis extra glabris, capsulis brevioribus, seminibus paucioribus glabris ; a *R. camptoneura* foliis subtus in axillis nervorum haud barbatis marginibus conspicue crenatis crenis magis approximatis, sepalis minoribus subaequalibus extra subsericeis neque costatis, antheris apice setosis neque bicornutis ; a *R. falcata* indumento ramulorum necnon foliorum, foliis conspicue regulariter crenatis, sepalis subaequalibus acutis extra subsericeis, antheris apice haud bicornutis differt.

Frutex vel arbor parva, ramulis gracilibus et pube brevi et pilis multo longioribus patentibus vel patulis inaequalibus plus minusve fulvis conspicue indutis. *Stipulae* lineari-lanceolatae, 5 7 mm. longae, siccitate sordide stramineae, costato-striatae, plus minusve pilosulae. *Folia* opposita, elliptica, elliptico-oblonga vel oblanceolato-elliptica, apice conspicue (vulgo 1–2·5 cm.) acuminata, basi conspicue oblique auriculiformi-cordatula, 7–18 cm. longa, 2·4–6 cm. lata, chartacea, regulariter subaequaliter crebre crenata, costa supra breviter pubescente nonnunquam glabrata subtus satis sparse fulvo-pilosa necnon nervis primariis subtus plerumque sparse pilosulis ceterum glabra, costa nervisque primariis supra prominulis subtus prominentibus his utroque costae latere 10–14 sursum arcuatis atque satis longe a margine anastomosantibus, rete venularum intricato utrinque prominulo ; petiolus 3–6 mm. longus, indumento ramulorum praeditus. *Inflorescentia* terminalis, simpliciter racemosa, dense fulvido-pubescens, tempore florendi satis brevis ad 4·5 cm. longa sed alabastris apice numerosis congestis, serius aliquantum elongata ; bracteae ovatae, acutae vel acuminatae, ad 1·75 mm. longae, extra pilis fulvido-flavis adpressis subsericeo-tomentosae ; bracteolae prope medium pedicellum vel infra alternatim dispositae, similes sed minores ; pedicelli 2–4 mm. longi, saepe cernui, glabrescentes, sub fructu elongati. *Flores* cremeo-flavidi, saepe secundi. *Sepala* ovata, acuta, subaequalia, ad 1·75 mm. longa, 0·8–1·4 mm. lata, ciliata, extra passim dense adpresse brunneo-subsericeo-pilosa. *Petala* satis anguste elliptica, obtusa, 4–5 mm. longa, 1·5–1·8 mm. lata, utrinque glabra, nonnunquam apice recurva, nonnulla basi plus minusve unguiculata. *Stamina* tota 3–3·75 mm. longa, glabra ; filamenta 0·5 0·75 mm. longa, glandula oblonga apice integra rotundato-obtusa filamento arcte omnino adnata (parte libera nulla) ac eo breviore ; antherae quam squamae connectivi angustiores, oblongae vel lanceolato-oblongae, 1·3–1·5 mm. longae, apice exappendiculatae sed paucisetosae (setis ut videtur 1–5) ; squama elliptico-lanceolata, marginibus basin versis minute erosis ceterum integra, 2·5–3 mm. longa, circiter 0·8 mm. lata. *Ovarium*

*Continued from *Kew Bulletin*, 1954, p. 616 (March, 1955).

globosum, villosum ; stylus rectus, 2–2·75 mm. longus, glaber ; ovula in quaque placenta 1. *Capsula* 1·5–1·7 cm. longa, pilis minimis patulis satis dense pilosula aliisque multo longioribus sparse pilosa ; semina 3, glabra, 5–6 mm. diametro.

British Guiana. Takutu Creek to Puruni River, Mazaruni, in mixed forest especially on lateritic soil, spreading shrub to 10 ft. high, fls. creamy yellow, August 14th 1944, *D. B. Fanshawe* in *Forest Dept.* no. 4913 (type in Kew Herb.). Madray-Bubu trail, Essequibo-Demerara Divide, in mixed forest on gravelly lateritic soil, a hard-wooded laxly branched shrub, flat-topped to 15 ft. high, fr. Feb. 8th 1944, *D. B. Fanshawe* in *Forest Dept.* no. 4424. Patwau Creek, Pomeroon River, from Kakaralli-mixed forest on loam, undergrowth tree to 20 ft. high and 3 in. diam., fr. Feb. 11th 1951, *D. B. Fanshawe* in *Forest Dept.* no. 6370.

Brazil : Pará : Utinga, forest reserve for Belém watershed 1–2 km. N. of Belém, slender tree with scented cream-yellow fls., August 24th 1942, *W. A. Archer* 7609 ; 1 mile S.W. of Instituto Agronômico do Norte, Belém, fr. Dec. 21st, 1942, *W. A. Archer* 8016 ; Tocantins River, sterile, Sept. 1836, *Sir Everard Home.*

Vernacular Names : *Mamusaré* (Arawak), in British Guiana ; *Marauba*, in Pará, according to *Archer* 7609 ; *Caripé*, in Pará, according to Sir Everard Home, who noted on his label, " The tree which produces the bark from the ashes of which, mixed with clay, the Indians on the Amazons, etc., form a crockery extremely light and frangible " (this is probably a case of mistaken identity, since *Caripé* is applied to trees of the *Rosaceae-Chrysobalanoideae*).

Brazilian material of this species has been confused with both *R. pubiflora* and *R. falcata*, but is easily distinguished by the ear-like obliquely cordate base of the leaves which is an important and constant diagnostic character in this genus (cf. in four species, all very distinct, *R. ulmifolia* (H.B.K.) Kze., *R. sylvatica* (Seem.) Kze., *R. endotricha* Sandw. and *R. lindeniana* (Tul.) Kze.). The glabrous petals and the smaller capsule with fewer glabrous seeds also make identification with *R. pubiflora* impossible.

Through the kindness of the late Dr. Karl Suessenguth, I have been able to examine the type material of both *Alsodeia falcata* and its var. *grandifolia* in the Munich Herbarium. So far as I can see, Eichler's description of the leaves, fruit and seeds of *R. falcata* was taken from Martius's specimens, 3 sheets, which bear no flowers. The rather scanty description of the floral parts was presumably taken from the Spruce collections cited by Eichler (see Mart. Fl. Bras. **13,** pars i, p. 387) which are now referred, perhaps rightly, to an independent species, *R. camptoneura* (Radlk.) Melchior, differing in its pubescent branchlets and in the leaves which are pubescent on the midrib and main nerves above and barbate-pilosulous in the axils of the main nerves beneath. The Martius specimens, from which surely the lectotype of *R. falcata* should be selected, have completely glabrous branchlets and leaves agreeing very well with those of the flowering Traill material from the Rio Purus, a specimen of which in the Gray Herbarium was used by Dr. S. F. Blake for his description of this species (see Contr. U.S. Nat. Herb. **20,** 512,ann. 1924). It is fortunate that Dr. Blake's interpretation of this species was

correct and that we can therefore use his description of the floral parts taken from Traill's material. The 5 Martius sheets of *Alsodeia falcata* var. *grandifolia* Eichl. differ from *R. falcata* in the indumentum of their branchlets and leaves, and I suspect that they should be referred to *R. camptoneura*. The Riedel collection cited as *R. falcata* by Eichler is represented at Kew by a specimen numbered 1581 which also has hairy branchlets and leaves ; the latter, however, are rounded at the base and the inflorescence is peculiarly short, so that this gathering may belong not to *R. camptoneura* but to some other species.

Apart from the obvious character of the base of the leaves, *R. neglecta* is at once distinguished from both *R. falcata* and *R. camptoneura* by the regularly, more closely crenate leaf-margins, the small, subequal, subsericeous sepals, and the setose (not 2-horned) apex of the anthers. The solitary ovule on each placenta is yet another distinguishing character.

The following simple key to the species of *Rinorea* occurring in British Guiana is based on material in the Kew Herbarium and does not make use of difficult staminal characters :

Leaves auriculiform-cordate at the base :

Bracts and sepals long and narrow, ribbed-striate ; petals hairy within *R. endotricha* Sandw.

Bracts and sepals short and ovate, not conspicuously ribbed ; petals glabrous within :

Infl. compound ; sepals ciliate, otherwise glabrescent ; petals not exceeding 3·5 mm. ; style bent at base ; seeds hairy *R. lindeniana* (Tul.) Kze.

Infl. simple ; sepals subsericeous outside ; petals exceeding 3·5 mm. ; style straight ; seeds glabrous . . . . *R. neglecta* Sandw.

Leaves cuneate to rounded at the base :

Branchlets and leaves quite glabrous :

Leaf acumen usually quite 2 cm. long ; sepals strongly ribbed ; ovary densely villous ; capsule and seeds hairy . *R. riana* Kze.

Leaf acumen only about 1 cm. long ; sepals not obviously ribbed ; ovary glabrous or nearly so ; capsule and seeds glabrous *R. flavescens* (Aubl.) Kze.

Branchlets pubescent or pilose ; leaves pubescent or pilose at least on the midrib, or barbate in the axils of lateral nerves beneath :

Petals pubescent outside along the median nerve ; sepals up to 2 mm. long, with a tawny-yellow indumentum when dried. *R. pubiflora* (Benth.) Sprague et Sandw. (*R. passoura* Kze.)

Petals glabrous outside ; larger sepals exceeding 2 mm., with a greyish indumentum . . . . . *R. brevipes* (Benth.) Blake (*R. laxiflora* (Benth.) Melchior)

In conclusion, it may be pointed out that a number of specimens of this genus distributed in recent years have been incorrectly named. *Krukoff* 4636, 5154 and 5391, all identified as *R. racemosa* (Mart.) Kze., are all *R.*

lindeniana (Tul.) Kze. ; *Krukoff* 8067 and 8219, distributed under the name *R. lindeniana* (Tul.) Kze., are not that species but should be compared with *R. flavescens* (Aubl.) Kze. ; *A. C. Smith* 2322 and 3080, distributed as *R. pubiflora* (Benth.) Sprague et Sandw., are *R. brevipes* (Benth.) Blake ; *Killip* 37271, distributed as *R. lindeniana* (Tul.) Kze., is *R. pubiflora* (Benth.) Sprague et Sandw. ; *Klug* 1949, determined as *R. falcata* (Mart. ex Eichl.) Kze., is *R. lindeniana* (Tul.) Kze.

Sapindaceae

Porocystis demerarae *Sandwith*, sp. nov. ; *P. toulicioidi* Radlk. affinis, floribus majoribus, petalis semper 5 laminis pro rata angustioribus intus pilosulis, squamarum loborum appendicibus quam lobis ipsis brevibus satis obscuris multo longioribus laminas subaequantibus, disco glabro, fructu majore differt.

Arbor parva, gracilis, eramosa, apice folia coronatim congesta horizontaliter patentia necnon inflorescentiam magnam terminalem gerens ; axis apicalis sub inflorescentia ipsa crassus, teres, 1–1·3 cm. diametro, ferrugineo-tomentosus, crebre conspicue lenticellatus. *Folia* gigantea, ad 75 cm. vel ultra longa, latitudine maxima 50–60 cm., ut videtur 9–11-foliolata, foliolis conspicue alternis ; petiolus crassus, subteres, ad 8 mm. diametro, basi incrassatus, ferrugineo-pubescens vel subglabratus, crebre lenticellatus ; rhachis similis sed gradatim superne gracilior et supra plus minusve canaliculato-applanata ; petioluli 3–10 mm. longi, supra canaliculato-applanati, basi infra conspicue bulbiformi-incrassati ; foliola elliptico-oblonga vel elliptico-lanceolata, apice conspicue acuminata, basi cuneata vel obtusa vel rotundata necnon plus minusve inaequilatera ac obliqua, 15–32·5 cm. longa, 6 10·5 cm. lata, integra, firme chartacea vel coriacea, siccitate supra griseo-olivacea subtus pallidiora nonnunquam brunnescentia, supra glabra subtus secus costam nervosque primarios dense ceterum sparse minute pubescentia, costa supra prominula subtus valde prominente, nervis primariis utroque costae latere 13–18 patule ascendentibus rectis tum nervo limbali valde conspicuo anastomosantibus omnibus supra tenuibus planis sed in pagina conspicue canaliculatis subtus prominentibus, rete venularum supra tenuissimo oculo nudo vix cernendo subtus tenuiter prominulo intricato. *Inflorescentia* gigantea, thyrsum pyramidalem ramosum ad 60 cm. longum ubique ferrugineo-tomentosum praebens, ramis ad 33 cm. longis saepe multo brevioribus angulatis sulcatisque saepe flexuosis dichasia crebra sessilia glomeruliformia ut in *P. toulicioidi* gerentibus ; pedicelli ad 2·5 mm. longi, prope medium articulati. *Flores* albidi, masculi tantum visi, 6 mm. longi atque lati vel sub plena expansione ad 8 mm. lati. *Sepala* 5, extima ovato-suborbicularia valde concava, interiora ovata ovato-oblonga vel obovato-oblonga, rotundato-obtusa, 3·6–4 mm. longa, 2·8–3·3 mm. lata, extra nisi margines versus sericeo-pubescentia necnon ciliolata. *Petala* 5, sepala longe excedentia, tota 5·5 mm. longa ; unguis lamina paulo brevior vel illam subaequans, 2–2·5 mm. longus, dorso pilosulus, intus glaber, marginibus ciliatis ; lamina lanceolata, basi ad 1·75 mm. lata, longitudinaliter plurivenosa, extra conspicue dense sericeo-pilosula, intus sparse pilosula ; squama alte bifida, lobis brevibus satis obscuris incurvis barbato-villosis, appendicibus dorsalibus corni-

formibus lanceolato-subulatis villoso-pilosulis valde conspicuis quam lobis ipsis multo longioribus atque laminam petali fere aequantibus nonnunquam apice spiraliter flexuosis vel apicem versus bifidis. *Stamina* 8 filamentis inaequalibus 3–4·5 mm. longis albido-villosulis apice attenuatis ; antherae ellipticae, vix 0·75 mm. longae. *Discus* patelliformis margine irregulariter sinuato, glaber. *Ovarii rudimentum* sericeo-villosulum. *Fructus* junior griseo-flavescenti-tomentosus, glandulis patelliformibus subimmersis conspersus atque punctatus ; stylus tomentosus, 1·75 mm. longus ; capsula matura formam hujus generis praebens, magna, circiter 4·5 cm. longa atque 6·5 cm. lata, coccis 3 valde inflatis fragilibus siccitate firme chartaceis subtomentellis reticulato-venosis ; semen globosum, siccitate nigrum, laeve, 1–1·2 cm. diametro.

British Guiana. Bartica, in secondary brown sand forest, fls. and young fr., April 13th 1952, *D. B. Fanshawe* in *Forest Dept.* no. 6872 (type in Kew Herb.) : tree 20 ft. high, 2 in. diam., unbranched with apical crown of horizontally spreading leaves and terminal rusty inflorescence 12–18 in. long, fls. palest cream or white, young fruit gibbous and trigonous. Bartica, April 1887, *Jenman* 3603 (Jenman Herb., Georgetown). Makauria River, Essequibo River, fls. and young fr., Nov. 1886, *Jenman* 2411 : slender tree with simple stem and terminal flower-panicle. Omai, left bank of Essequibo River, in mora forest, fr. May 26th 1948, *D. B. Fanshawe* in *Forest Dept.* no. 5611 : tree 15–20 ft. high, 2–3 in. diam., unbranched with small whorled crown, capsule tripartite, thin-skinned, blown-out, with one globose seed in each compartment.

Vernacular name (Arawak), *Hikuribianda*, a name also given to *Toulicia pulvinata* Radlk. and *Simaba cedron* Planch.

This extremely interesting species, known from four collections from the Essequibo River region, has the characteristic fruits of the hitherto monotypic genus *Porocystis* Radlk. It differs from *P. toulicioides*, of the Rio Negro, Brazil (where *Robert Schomburgk* 986, one of the original gatherings, was almost certainly collected, not in British Guiana as stated by Radlkofer), by a number of striking characters which, in a larger genus such as the very closely related *Toulicia*, would have been regarded by Radlkofer as warranting assignment to an independent section. The most important of these characters is the constant presence of 5 petals (there are only 4 in *P. toulicioides*). The flowers are conspicuously larger, and so are the fruits and seeds ; while the disk is glabrous, not tomentose. The petals differ widely from those of *P. toulicioides*, the lamina being narrower and lanceolate instead of deltoid-ovate, and distinctly pilosulous (not glabrous) on the inner surface, while the scale has very short and indistinct incurved lobes but very long and conspicuous dorsal appendages (on the petal-scale of *P. toulicioides* these appendages are not much longer than the conspicuous lobes and are much shorter than the lamina of the petal). It seems likely that the leaves and leaflets of the new species are relatively larger than those of *P. toulicioides*, and the lower surface of the leaflets seems to be less intricately reticulate.

Radlkofer omitted to give a number of measurements of the floral parts of *P. toulicioides*. Flowers of *Schomburgk* 986 and *Ducke* 685 have been examined and show that the sepals are 2–3 mm. long, 1·75–2·3 mm. broad ; the 4 petals are 2·75–4 mm. long, the claw being about 0·8–

1·5 mm. long, and the lamina 2–2·5 mm. long and about 1·3–1·7 mm. broad ; the unequal filaments are 1·75–4 mm. long, and the anthers 0·3–0·6 mm. long ; the disk varies from depressed-pulvinate to platter-shaped.

The fruits of a number of species of *Toulicia* are still unknown (see Engl., Pflanzenreich, **4,** 165, 618 629) and, as the two genera cannot be distinguished without them, it is possible that some of these species will be found to belong to *Porocystis*. If we ignore the fruit of *P. demerarae*, it would be placed by its other characters in Radlkofer's section *Kreagrolepis* of *Toulicia* and, within this section, it would come nearest to *T. acuminata* Radlk., of Manáus, Rio Negro, of which the fruits are unknown. I have seen no material of *T. acuminata*, but it can easily be distinguished from *Porocystis demerarae*, according to the description, by the large number (17) of much smaller and narrower leaflets which are strongly unequal-sided at the base and glabrous, and by the shortly stalked dichasia of the inflorescence. Radlkofer unfortunately did not give measurements of the floral parts, and his description of the petal-scale is meagre.

Only male flowers have been found on the flowering collections of both species of *Porocystis*. But well developed young fruits are found on these inflorescences, and protogyny may therefore be assumed.

The Flora of Egypt* (*Liliaceae-Musaceae*). The third volume of this invaluable work (truly described as " monumental " in Prof. Efflatoun's introduction) continues in the tradition of its predecessors, providing the enquirer with a wealth of information on a host of subjects. Here one can find notes on *Allium* in mummification ; on the *Yucca* moth ; on the cultivation of Saffron ; on the history of the Banana, or the significance of *Ensete* in hieroglyphs—to mention only a small fraction of the total information supplied. Taxonomy, biology, horticulture, pharmacology, etymology, archaeology, history and economics all fall within the scope of this astonishing work. Most botanists would begin to weary before one quarter of such a task was completed, but the authors seem to gather energy and enthusiasm as each volume is published, and we see taking shape a Flora which will ultimately surpass all others in the breadth and diversity of its contents.

Does taxonomy tend to be smothered amidst such a welter of learning ?

Perhaps it does, but is it not also possible that taxonomists attach too much importance to a subject which is, after all of unlimited interest only to a very limited number of people ? These volumes try to cater for many tastes, and if the taxonomist is temporarily disconcerted, let him find relief in the knowledge that many will be grateful to Dr. Tackholm and Mr. Drar for their extravert, encyclopaedic concept of a Flora.

R. D. Meikle.

* Flora of Egypt, vol. III, by Vivi Tackholm and Mohammed Drar. Cairo University Press, 1954, pp. 664. (No price stated).

NOTES ON ASIATIC GRASSES : XXIV.

The Genus Arundinella Raddi in India, Burma and Ceylon.

N. L. Bor

The genus *Arundinella* was established by Guiseppe Raddi in his book *Agrostographia Brasiliensis* 37 (1823) t. 1, fig. 3, where he gives an adequate description of the genus *Arundinella* and of the species *A. brasiliensis*, which are, moreover, supported by a figure. The generic name is apparently the diminutive of the Latin word " arundo " and means a " little reed ". While the name is quite suitable for some of the species, there are many which are truly herbaceous.

The discrimination of the species of the genus has given a great deal of trouble because of the effect that changes in habitat have upon the vegetative parts and upon the size of the panicle. The plants respond to a richness of habitat with such exuberance as to be quite different in appearance from the same species growing on poor soil. Consequently when numerous collections from all kinds of habitats were made, the range of adaptability of the species to its environment became plain and therefore a clearer picture of the limits of a species could be drawn. When Sir Joseph Hooker was writing the seventh volume of the Flora of British India he had in some instances only meagre collections to work on, and therefore it is not at all surprising, in fact, it was inevitable, that species were established which were only habitat forms. The writer has had the advantage of very much richer collections than his predecessors had, but even now, far more material is needed from South India and Ceylon to be quite sure of the status of a few species.

The writer is under great obligation to the authorities of St. Xavier's College, Bombay, for making available the rich Blatter collections, and to Shri M. B. Raizada, Forest Botanist, Forest Research Institute, Dehra Dun, for sending certain critical specimens. The specimens cited are in the Kew Herbarium, except where otherwise stated.

Historical

Trinius was the first to give a generic name to the genus when he described *Goldbachia mikani* in Sprengel, *Neue Entdeckungen* 2, 81 (1821). Unfortunately the generic name *Goldbachia* is a later homonym of De Candolle's cruciferous genus *Goldbachia*. Reichenbach tried to put this right in 1828, when he pointed out that Trinius' *Goldbachia* was invalid and proposed the name *Calamochloe* in its place. In the meantime (1823), unfortunately for him, Raddi had published the generic name *Arundinella*, by which name the genus must be known. From 1829-1834 the genus received four more names.

From the start the relationship of the genus to the other genera in the family was a puzzle to the many who worked on the *Gramineae* in the 19th century. Kunth, for example, compared his genus *Brandtia* with *Eriachne*, a genus which he placed in the *Avenaceae*. Trinius simply described *Goldbachia mikani* without assigning it to any section or tribe. When Reichenbach replaced *Goldbachia* by *Calamochloe*, he included the latter in the *Saccharinae*, among other andropogonous genera. Presl described his *Thysanachne* as belonging to the *Gramineae Bromeaceae*, while *Riedelia*,

an unpublished name of Trinius, was placed among the synonyms of *Arundinella brasiliensis* Raddi, and with the latter was reduced in synonymy to *Ischaemum hispidum* Humb. et Kunth in Kunth, Enum. Pl. **1,** 515 (1833).

Coming down to Link, we find that he placed his *Acratherum* in *Tristeginae*, a suborder described as " Spiculae semibiflorae. Valvula exterior neutra a glumae valvis structura differt ", a formula which was sufficiently nebulous as to embrace genera which did not easily fall into tribes or groups already described. Hackel, *The True Grasses*, 68 (1896), retained this name for one of his tribes, considering it to be a transitional tribe between *Andropogoneae* and *Paniceae*. He, however, defined the tribe a little more precisely as " spikelets all hermaphrodite, 1-2-flowered in panicled racemes, axis continuous. Empty glumes three, the third sometimes hairy, having the function of a flowering glume of a male flower.". He succeeded in placing in this tribe, besides *Arundinella*, *Melinis*, *Beckera*, *Phaenosperma*, *Triscenia*, *Thysanolaena* and *Andropogon*, genera which would to-day be placed in at least five distinct tribes.

Bentham and Hooker maintained the tribal name *Tristegineae* with Hackel's characters more or less unchanged, remarking that it was a tribe connecting the *Paniceae* with *Andropogoneae* and *Agrostideae*. In this tribe were maintained all the genera so placed by Hackel except *Beckera* and *Arthropogon*. Moreover, to it were added such genera as *Garnotia* and subsequently in Stapf's handwriting, *Cyathopus*, *Woodrowia* and others whose relationships were not at once apparent.

Stapf realised in 1898, that the time had come to rescue *Arundinella* from a group with which it had little in common, and in which even the remainder of the genera could with advantage be placed logically elsewhere. For this purpose he created the tribe *Arundinelleae* in *Flora Capensis* **7,** 314 (1898). This tribe has been recognised by C. E. Hubbard [in Hutch. *Families of Flowering Plants*, *Monocots*. 224 (1934)] and in the latest attempt at the classification of the *Gramineae* by Pilger in *Bot. Jahr.* **76,** 326 (1954), and is now firmly established.

Classification

In all Floras in which this genus occurs, use is made of the awned or awnless condition of the spikelets for a primary division. A sub-division makes use of the fact that in some species the awn is flanked on each side by a bristle. Other characters used to delimit species are woolly base, annual or perennial habit, spikelets in pairs or solitary, and so on. It will be worth while to examine some of the characters upon which reliance is based to separate species.

It may be mentioned quite briefly that no reliance whatever can be placed on panicle shape (except *A. spicata* Dalz.) or size, hairiness or its absence on leaves or stem, hairs or bristles or their absence on spikelets and pedicels. *A. spicata* Dalz. is exceptional by reason of its Setaria-like panicle which readily separates it from all other species.

The most recent study on the genus *Arundinella* is that published by Keng in Science Reports of the National Central University, China, ser. B, Biology, 2, no. 3 (1936). I am indebted to Mrs. Agnes Chase for

kindly presenting me with a photostat copy of this important paper. The author of the present study comes to somewhat different conclusions from Prof. Keng in respect of a number of species. This may be ascribed to the very ample material the author had at his disposal.

Awns

" Awned " and " awnless " as used in floras, are merely relative terms. The awned forms usually have a well marked awn several millimetres in length which can be readily separated into a twisted chestnut-coloured column and a colourless bristle. The " awnless " forms either have no trace of an awn (*A. leptochloa*, etc.) or possess a very short awn which can also be separated into a twisted column and colourless bristle, the tip of the latter hardly exceeding the spikelet.

It will come as a shock to some agrostologists to learn that awns may be present in some plants of the same species and not in others.

The classic example of this is *A. laxiflora* Hook. f. Gardner's sheet no. 1007 which is the basis of the species has two plants upon it—the spikelets show no trace of an awn. His 1009 has also two plants upon it—each spikelet has a geniculate awn. The specimens on both sheets are identical in every other way. All other species which are said to be awned, leave traces of the awn, which is readily shed, if they appear to be awnless.

The species *A. setosa* Trin. shows very great variation in size of panicle ; the spikelets, however, are of a characteristic shape not readily put into words. The typical form has a geniculate awn to the upper lemma and two bristles, one on each side. These bristles can, however, be completely absent or very short, as in *C. setosa* var. *lanifera*. The absence of the side bristles and the dropping of the central awn were responsible for the erection of *A. mutica* Nees, which is no other than *A. setosa*.

It will, therefore be plain that a dichotomous key cannot with safety be based on the presence or absence of awns or their number. Provision must be made in the key for deviations from this state, where known. The writer has endeavoured to do this in the key in this paper.

Woolly base

A. setosa var. *lanifera* C. E. C. Fischer has a silky rather than a woolly base. *A. villosa* Nees, however, has a crisp curly, yellowish-white wool at the base and this character can be relied upon.

Habit

The writer's confidence in the reliability of the annual or perennial habit as an indication of specific difference, has been gravely shaken by the fact that the spikelets of *A. nervosa*, an undoubted annual, are identical with those of *A. setosa*, a typical perennial. It is true that there is a definite facies about the annual, particularly in the secund arrangement of the spikelets on the branches, but one looks in vain for something tangible, apart from the habit, which could be used to separate them.

Fischer [*Flora of Madras* 1801 (1934)] actually reduced *A. nervosa* to the synonymy of *A. setosa*, but the writer is not prepared to go so far. It is hoped that some botanist in Bombay or Madras will be able to solve the

problem of *A. nervosa*. Is the species a true annual or is it a perennial flowering freely in its first year ?

The following species are unmistakable by reason of certain peculiarities.

A. bengalensis (Spreng.) Druce is easily distinguished from all other species by the ascending short branches densely covered with secund awnless or very shortly awned spikelets.

A. purpurea Hochst. ex Steud. has leaves and sheaths which turn yellowish-green as they dry.

A. laxiflora Hook. f. is remarkable for its long-pedicelled spikelets which are often solitary and alternate on the branches.

The pedicels of *A. setosa* Trin. almost always have setae just below the spikelet, and are a guide to many doubtful or immature specimens.

A. tuberculata Munro is distinguished by its unusually long spikelets and being covered by a dense covering of tubercle-based hairs.

Species in India, Ceylon and Burma

Hooker recognised 24 species as growing in the area concerned. Their fate in this revision is revealed in the following table :—

Species in Flor. Brit. Ind.	Species in the revision.
A. avenacea Munro ex Thw.	*Jansenella griffithiana* (Muell) Bor
A. tuberculata Munro ex Lisboa	*A. tuberculata* Munro ex Lisboa
A. mesophylla Nees ex Steud.	*A. mesophylla* Nees ex Steud.
A. nervosa Nees ex Steud.	*A. nervosa* Nees ex Steud.
A. setosa Trin.	*A. setosa* Trin.
A. khaseana Nees ex Steud.	*A. khaseana* Nees ex Steud.
A. agrostoides Trin.	*A. ciliata* (Roxb.) Nees *A. holcoides* (Kunth) Trin.
A. tenella Nees ex Steud.	*A. pumila* (Hochst.) Steud.
A. pygmaea Hook. f.	*A. metzii* Hochst. ex Miq. (depauperate)
A. metzii Hochst. ex Miq.	*A. metzii* Hochst. ex Miq.
A. lawii Hook. f.	*A. metzii* Hochst. ex Miq.
A. villosa Arn. ex Steud. var. *wightii*	*A. villosa* Arn. ex Steud.
A. villosa Arn. ex Steud. var. *heynei*	*A. vaginata* Bor
A. villosa Arn. ex Steud. var. *himalaica*	*A. hookeri* Munro
A. birmanica Hook. f.	*A. birmanica* Hook. f.
A. brasiliensis Raddi	*A. nepalensis* Trin.
A. brasiliensis Raddi in part	*A. intricata* Hughes
A. fuscata Nees ex Buese	*A. purpurea* Hochst.
A. capillaris Hook. f.	*A. setosa* Trin.
A. laxiflora Hook. f.	*A. laxiflora* Hook. f.

Species in Flor. Brit. Ind.	Species in the revision.
A. wallichii Nees ex Steud.	*A. bengalensis* (Spreng.) Druce
A. clarkei Hook. f.	*A. decempedalis* (O. Ktze.) Janowsky
A. leptochloa Hook. f. *A. lawsoni* Hook. f. *A. gigantea* Dalz.	*A. leptochloa* (Nees ex Steud.) Hook. f.
A. blephariphylla Hook. f.	*A. blephariphylla* Hook. f.
A. thwaitesii Hook. f.	*A. thwaitesii* Hook. f.
A. spicata Dalz. in *dubia*	*A. spicata* Dalz.

The reasons for the reduction of certain species to synonymy as well as the promotion of certain varieties will be found under the species concerned or in the discussion of groups of critical species. The reason for present-day nomenclature as opposed to that of Hooker will be found in the references to the literature and to the synonymy. *Arundinella avenacea* Munro was made the basis of a new genus, *Jansenella*, in Kew Bull. **1955,** 93 (1955) by the writer.

Groups of Critical Species

Arundinella setosa Trin., *A. nervosa* (Roxb.) Nees and *A. mutica* Nees.

A. nervosa (Roxb.) Nees is the only annual in this group and can therefore be separated easily on this character alone. The justification for its inclusion in the group is the extraordinary similarity of its spikelets to those of *A. setosa* Trin., in fact they are identical, and this similarity extends even to the pedicels which are decorated with the same characteristic bristles. This similarity evidently led Fischer [Flor. Madras 1801 (1934)] to reduce *A. nervosa* to the synomy of *A. setosa*. The present writer is not prepared to go so far, but he must confess that this similarity between an annual and a perennial is disturbing, since one is led to believe that the genetical make-up of an annual must be profoundly different from that of a typical perennial.

A. setosa Trin. is a very variable species as regards size of panicle and vegetative parts, pubescence and so on, but when normal it can be easily recognised by the large spikelets, the awn of the upper lemma being flanked by two bristles and by the tips of the pedicels being almost always decorated with stiff bristles. It is, however, not always normal and the awns of the upper lemma upon which so much reliance has been placed in the past, are sometimes reduced in size or, rarely, absent altogether. It is this latter circumstance which has given rise to the species *A. mutica* Nees.

A. mutica Nees was called *A. capillaris* by Hooker on the grounds that the latter epithet was more appropriate for a species, which, although apparently awnless, possessed spikelets from which the awns had fallen away and, therefore, not really muticous.

The specimen upon which Nees based his *Arundinella mutica* is the specimen which bears the Wallichian number 8665A to which Wallich added the provenance of the specimen, as *Andropogon capillaris* Herb. Heyn. The specimen on the sheet in the Wallich Herbarium at Kew has a hairy base. The spikelets in shape are typically those of *A. setosa*, the

central awn has fallen off and the side bristles are not evident. The specimen is a good match for Fischer's *A. setosa* var. *lanifera* Fischer. It is pertinent to recall that Fischer mentioned that the side bristles in his variety were very short.

I can find no evidence that Heyne ever called a specimen in his Herbarium *Andropogon capillaris*. This name is not mentioned in Roth's *Novae Plantarum Species* (1821) in which Heyne's specimens were written up, nor by Roemer and Schultes in the 15th edition of Linnaeus' *Systema Vegetabilium*, to whom Roth lent the mss. of his book. There is, however, a sheet in the Kew Herbarium from Rottler's Herbarium, with a label on which is written in Rottler's hand, " Andropogon capillare nob." Is it possible that Herb. Heyne. was written in mistake for Herb. Rottl. ? It may, indeed, be so, for Hooker identified this very sheet from Rottler's Herbarium as *A. capillaris*. The specimen, however, is typical *Arundinella setosa* Trin.

Hooker also mentions no. 3338 in Herb. Wight. from the Pulney Hills, Madras State. I have not been able to trace this number in the Herbarium at Kew, but there is a sheet no. 3378 from the Pulney Hills. Hooker identified the specimen as *A. capillaris* Hk. f. ? and noted, " very near *A. capillaris* but branches of the panicle more numerous, shorter, spikelets more numerous, smaller ". From Hooker's remarks under *A. capillaris* on p. 75, Flora of British India, regarding Wight's Pulney specimens, I feel sure he is referring to the sheet no. 3378. The species on the sheet is *Arundinella nepalensis* Trin.

One wonders what Lisboa had in mind when he mentioned [*Journ. Bomb. Nat. Hist. Soc.* **5,** 344 (1890)] that *Arundinella mutica* was common all over Bombay. Blatter & McCann saw no specimens, and there are none in the Blatter Herbarium of St. Xavier's College, Bombay.

The only conclusion that can be drawn from the above is that *A. mutica* Nees (*A. capillaris* Hook. f.) was based on abnormal specimens of *A. setosa*, and the name must be merged in the synonymy of the latter.

A. gigantea Dalz., *A. lawsonii* Hook. f. and *A. leptochloa* (Nees ex Steud.) Hook. f.

One can only say with regard to the above named species that when compared, their panicles and vegetative parts show a variation in size and shape which is no whit greater than that exhibited by such species as *A. nepalensis* or *A. setosa*. There is no specific difference in spikelet size and structure. Hence I propose to name the species *A. leptochloa* with the other two names as synonyms. I would also have added *A. blephariphylla* were it not for the fact that it has a different geographical distribution and almost solitary long-pedicelled spikelets. There is only one specimen of the latter at Kew and further collections are badly needed.

Arundinella metzii Hochst. *A. lawii* Hook. f. and *A. pygmaea* Hook. f.

J. D. Hooker described the new species *Arundinella lawii* Hook. f. in Trimen, *Handb. Flor. Ceyl.* **5,** 180 (1900). He went on to say that this

* In the interleaved copy of Steudel's *Synopsis* at Kew, I find Munro has remarked with reference to *A. mutica*, " A form of No. 2, *A. setosa*, from which the two awns have fallen away ". But a later note reads, " Hb. Hk. Wall. Cat. 8665 ! I now believe *mutica* to be distinct." This does not alter the opinion expressed above.

species had been considered in the *Flora of British India* to be a form of *A. agrostoides* Trin., having been named as such by Munro (in Herb. Ind. Or., Hook. f. and Thoms.). The species was, however, re-examined with aid of specimens collected by Woodrow in the Konkan, Madras State, and Hooker came to the conclusion that it must rank as a distinct species, characterised by its perennial habit, much taller stems, long leaves and very long, drooping, pyramidal panicle.

An examination of the type folder of the species at Kew revealed that two sheets collected by Law in the Konkan, and two others collected by Woodrow in the same place, possessed spikelets which matched those on the fragment from the type sheet which is in the Herbarium at Peradeniya. Of the four sheets, only Woodrow's shows the base of the plant. The base, however, is not that of a perennial but of an annual.

It was quite possible, however, that the type sheet in the Peradeniya Herbarium might prove to be a perennial. In order to settle the question, Mr. Senaratne, Research Assistant in Systematic Botany, was good enough to forward the sheet for examination. It proved to be incomplete, merely consisting of the panicle and a portion of the culm with leaves. The base is not present, and therefore one must assume that Hooker misinterpreted Woodrow's plant which was the only complete gathering of the species seen by him.

The fact that the plant is an annual and not a perennial, puts a different complexion on its status as a distinct species. Actually there is no difference whatever in the shape and size of the various parts of the spikelet in *A. lawii* from that of those in *A. metzii*. The spikelets of the latter are indeed glabrous and those of the type of *A. lawii* more or less hairy with tubercle-based hairs, but the amount of indumentum present on the spikelets of species of *Arundinella* is of no account, and indeed, its absence altogether, even though it gives a different " look " to a plant, is not of any value as a specific difference. I have therefore, after an examination of very numerous sheets from the Blatter Herbarium in Bombay, come to the conclusion that *Arundinella lawii* must be considered as synonymous with *A. metzii*. The hairy spikelets of *A. lawii* are nearly always accompanied by nodes which are covered by an appressed silky pubescence. Even this, however, is not constant and there are specimens which have glabrous spikelets and silky nodes.

As sometimes happens, it is the type of a plant which is atypical when a whole population is studied. So it is with *A. metzii*. The specimen upon which Hochstetter based *Arundinella metzii* is a rather poor example of the dimensions which that species can attain, and, moreover, it is far rarer. In fact it is the hairy form previously known as *A. lawii*, which is probably the most frequent species of the genus in Western India.

The writer published a paper in the Journ. Ind. Bot. Soc. **26,** 62 (1948) in which he detailed the differences between *A. pumila* and *A. pygmaea*. The differences are, of course, considerable, and the paper was prompted by the fact that Keng in Sci. Rep. Nat. Cent. Univ. China 2, 3, 43 (1936) had reduced *A. pygmaea* to the synonymy of *A. pumila*. Hooker says that *A. pgymaea* is closely allied to *A. tenella* (*A. pumila*) but very much smaller.

Having steeped himself in *Arundinella* for some months, the writer is now of the opinion that while there are no grounds whatever for sinking *A. pygmaea* in *A. tenella*, there are no spikelet differences between *A. pygmaea* and *A. metzii*. *A. pygmaea* is obviously an extremely depauperate specimen of the latter.

Arundinella holcoides (Kunth) Trin., *A. agrostoides* Trin. and *A. birmanica* Hook. f.

Arundinella holcoides (Kunth) Trin. is based on a species collected by a Mr. Raynaud at Pegu in Burma. Kunth, in his *Révision des Graminées* (1829) made this species the type of a new genus which he called *Brandtia*. The species is illustrated in t. 170 of that work and is an undoubted *Arundinella*. This was recognised by Trinius who made the transfer in 1836 [in *Bull. Acad. Sci. Petersb.* **1,** 71 (1836)]. In the same year Trinius in his *Species Graminum, Icones*, **3** (1836) t. 265, described a new species of *Arundinella* under the name of *A. agrostoides*. If the figure of Kunth is compared with that of Trinius, it is quite evident, allowing for the variation in panicle size in this genus, that the two species are the same. In this way *A. agrostoides* entered the synonymy of *A. holcoides* (Kunth) Trin. There is a sheet of *A. agrostoides* Trin. at Kew from the " locus classicus " and there is no doubt about what Trinius considered this species to be.

Arundinella agrostoides Trin. was one of the species described by Hooker in the *Flora of British India*. The material of the species so named by Hooker falls into two distinct parts. There are the specimens collected in Burma and those collected in Madras State. The Burmese specimens are identical with *Arundinella agrostoides* Trin. or, to call it by its correct name, *A. holcoides* (Kunth) Trin. In this species the tip of the lower glume equals or slightly exceeds the tip of the lower lemma in the spikelet, a feature which is well brought out in the drawings of *A. agrostoides* and *Brandtia holcoides*.

The species which grows in India is quite different in this respect. The lower glume exceeds by a great deal the tip of the lower lemma and this grass has an altogether different facies. Fortunately there is no need to describe a new species, for Roxburgh described this very species as *Holcus ciliatus* in his *Flora Indica*, 1, 321 (1820), where he states the provenance of the plant to be Coromandel. In the Icones Roxburgheanae, preserved at Kew, there is an excellent drawing of *Holcus ciliatus* which leaves no doubt whatever what Roxburgh meant by this species. The same species was given the name *Arundinella* (*Acratherum*) *ciliata* in Wight's Catalogue n. 1666 (1834), though I have not been able to ascertain if Nees knew of Roxburgh's *Holcus ciliatus* or not. I am assuming that he did* and am calling this plant *Arundinella ciliata* (Roxb.) Nees. Steudel did not have the name *A. ciliata* and he could make nothing of Roxburgh's description of *Holcus ciliatus*. A description of *A. ciliata* Nees was given by Miquel in Verh. Konink.-Nederl. Inst. **3,** pt. 4, 30 (1851) mainly because of the need to give descriptions to certain species of which this was one, which up till then existed merely as names. It is obvious that Miquel was quite ignorant of Roxburgh's drawing.

* If he did not know that Roxburgh's *Holcus ciliatus* was the plant he called *Arundinella ciliata*, it is a remarkable coincidence that they both use the same specific epithet.

Another species which is closely allied to the above two species is that called *Arundinella birmanica* by Hooker. The type was collected in Pegu, which it will be remembered is the " locus classicus " of *Brandtia holcoides* Kunth. The construction of the spikelets is similar to that of *A. holcoides* but the spikelets are consistently larger, and it is altogether a more robust plant. The spikelets are 4·5–5 mm. long, as against 3·5 mm. in *A. holcoides* (Kunth) Trin.

Generic Description

Arundinella *Raddi*, Agrost. Bras. 37 (1823) t. 1, fig. 3.

Goldbachia Trin. in Spreng., Neue Entdeck. **2,** 81 (1821)*.

Calamochloe Reichb., Consp. 52 (1828).

Thysanachne Presl, Sym. Bot **1,** 11 (1829) t. 6.

Brandtia Kunth, Rév. Gram. **2,** 511 (1830) t. 170.

Riedelia Trin. ex Kunth, Enum. Pl. **1,** 515 (1833).

Acratherum Link, Hort. Berol. **1,** 230 (1834).

Spikelets imperfectly jointed on the tips of long or short scabrid pedicels, in pairs, rarely solitary (*A. laxiflora* Hook. f.), occasionally supported by bristles from the tip of the pedicel, arranged in open decompound panicles, in either very dense or loose racemes on a short or long rhachis, usually ascending, or rarely in a spiciform inflorescence, lanceolate or even ovate, acute or acuminate, usually gaping ; rhachilla readilly disarticulating between the florets, tardily between the upper glume and lower floret. *Florets* 2, heteromorphous ; the lower floret ♂ or barren ; the upper hermaphrodite, smaller than the lower. *Glumes* persistent ; the lower lanceolate, ovate or nearly orbicular, membranous, 3–5-nerved, acute or aristulate, about half to two-thirds the length of the upper ; the upper almost as long as the spikelet, 5–7-nerved, elliptic in the lower two-thirds, linear compressed and beaked in the upper third, acting as a scabbard for the awn of the upper lemma, both smooth and glabrous or scabrid on the nerves or densely hispid with tubercle-based hairs on the nerves and sometimes on the internerve spaces. *Lower floret* subpersistent ; *lemma* acute or subapiculate, oblong- or ovate-oblong-obtuse, usually 5-nerved with lateral pair close together and well separated from the central nerve, smooth and glabrous ; *palea* 2-keeled as long as, or somewhat shorter than the lemma. *Upper floret* subterete or more often dorsally compressed with an obtuse callus which is glabrous or long or short bearded at the sides ; *lemma* membranous to chartaceous, eventually thinly coriaceous, scaberulous to scabrid in the upper-half, faintly 5-nerved, rounded or 2-lobed or 2-aristate at the tip, usually awned between the lobes but the unawned condition even in the same species is frequent ; *palea* of the same texture, smooth and glabrous or scabrid or subpapillose between the keels ; *stamens* 3 ; *styles* 2 ; *stigmas* plumose ; *lodicules* 2, cuneate ; *grain* ellipsoid ; *hilum* punctiform ; *embryo* half as long as the grain.

Perennial or annual grasses ; leaves elliptic-acuminate, oblong or linear, sometimes very broad and cordate at the base ; ligules very narrow, membranous ; spikelets pale, green or dark purple.

* **Goldbachia** *DC.* (1821) is a genus of *Cruciferae*.

Key to the species of *Arundinella*

Inflorescence cylindric, very densely spicate, 7·5–10 mm. wide, 2–5 cm. long ; plant looks superficially like a *Setaria* . . . 1. *A. spicata*

Inflorescence not at all spicate, either a dense panicle of racemes of spikelets or in ample or contracted panicles :—

Upper lemma with two setae, one on each side of the awn, at the tip :—

Perennials :—

Spikelets usually loose, distinctly pedicelled, 4·5–7·5 mm. long, usually but not always supported by stiff setae at the tip of the pedicel :—

Base glabrous ; spikelets 6·5–7·5 mm. long 2. *A. setosa* var. *setosa*

Base woolly ; spikelets 4·5–5·5 mm. long 2. *A. setosa* var. *lanifera*

Spikelets crowded, subsessile or very shortly pedicelled in a panicle made up of short crowded spicate racemes :—

Culms stout, very densely bearded at the nodes ; spikelets 6–8 mm. long ; upper lemma 3–4 mm. long ; panicle at least 15 cm. long, reaching 50 cm. long . . 3. *A. khaseana*

Culms slender, glabrous or very slightly pubescent at the nodes ; spikelets 4–5 mm. long ; upper lemma 2 mm. long ; panicle 4–12 cm. long . . . 4. *A. mesophylla*

Annuals :—

Whole plants covered with tubercle-based hairs ; spikelets long, acuminate, 7·5–9·5 mm. long . . . 5. *A. tuberculata*

Plants not entirely covered with tubercle-based hairs ; spikelets at most 5–6 mm. long ; similar in appearance to *A. setosa* and often supported by bristles at the tip of the pedicel, but upper glume even more acuminate ; size of panicle very variable 6. *A. nervosa*

Upper lemma with a single awn or the awn absent :—

Plants woolly at the base ; spikelets awned :—

Panicle of short racemes (3 cm. long or less) of crowded spikelets 7·5 mm. long, short-pedicelled, covered with tubercle-based bristles . . . . . 7. *A. villosa*

Panicle spreading, of long slender branches up to 12 cm. long ; pikelets 4·5–5·5 mm. long, long-pedicelled, few, distant 2. *A. setosa* var. *lanifera*

Plants not woolly at the base though the sheaths may be hirsute or the basal buds silky :—

Upper lemma not awned, if so, awn not more than 2 mm. long ; base of upper lemma naked :—

Spikelets 4–7·5 mm. long ; tips of the pedicel with stiff setae ; basal buds silky . . . . . 2. *A. setosa* var. *lanifera*

Spikelets 2·5–3·5 mm. long ; tips of the pedicel devoid of setae ; basal buds glabrous :—

Panicle very large 30–70 cm. long by 15–20 cm. wide ; branches long undivided 8–20 cm. long ; very stout grass 8. *A. decempedalis*

Panicle very much smaller ; culms not more than 3 mm. thick below the panicle :—

Leaves conspicuously cordate or rounded at the base :—

Panicle of very numerous branches bearing densely crowded spikelets ; spikelets 2·5 mm. long ; leaves 45 cm. long. 3–4 cm. wide, coriaceous, glabrous ; peduncle glabrous below the panicle 9. *A. leptochloa*

Panicle rather open of few branches and more or less distant pairs of spikelets, never dense ; spikelets 3–3·5 mm. long ; leaves 25 cm. long, 2–2·5 cm. wide, chartaceous, with a fringe of bulbous-base hairs along the margins ; peduncle below the panicle with spaced tubercle-based hairs . 10. *A. blephariphylla*

Leaves narrowed at the base or slightly rounded :—

Panicle cylindrical ; branches up to 5 cm. long, usually 2–3 cm. long, covered with densely crowded secund spikelets with hispidulous glumes ; occasionally an awn present, not more than 2 mm. long 11. *A. bengalensis*

Panicle not as above :—

Spikelets solitary on the branches, shorter than the pedicels ; panicle axis and branches quite glabrous . . . . . 12. *A. thwaitesii*

Spikelets binate on the branches ; branches and axis of panicle scabrid, pilose at junction of branch and axis ; spikelets 2·25–3·75 mm. long ; stout plants with large dull purple panicle or slender with greenish panicles . . 9. *A. leptochloa*

Upper lemma bearing a geniculate awn :—

Spikelets small, not more than 2 mm. long ; upper lemma 1 mm. long ; leaf-blades elliptic-acute or elliptic-acuminate, membranous to chartaceous 3–25 cm. long, 5–25 mm. wide ; inflorescence a very effuse panicle 10–30 cm. long with many spikelets . . . . . 13. *A. pumila*

Spikelets well over 2 mm. long ; leaves not as above :—

Spikelets glabrous or with a few short hairs on the keels of the glumes :—

Perennial grasses :—

Panicle 10—45 cm. long, usually very effuse ; axis smooth and glabrous :—

Panicle 10–15 cm. long ; pedicels much longer than the spikelets . . . . . 14. *A. laxiflora*

Panicle 10–45 cm. long ; pedicels shorter than the spikelets or not much longer . 15. *A. nepalensis*

Panicle usually contracted ; axis very scabrid or markedly ciliate :—

Leaves rounded at the base or subcordate, usually collected at the base of the plant, drying yellowish green ; sheaths and leaf-margins with tubercle-based hairs :—

Pedicels short ; panicle compact 16. *A. purpurea* var. *purpurea*

Pedicels very long ; panicle effuse ; spikelets sometimes proliferous 16. *A. purpurea* var. *pedicellata*

Leaves linear-acuminate, not rounded at the base 17. *A. intricata*

Annual grasses :—

Pedicels of the spikelets very long, up to 16 mm. long ; panicle not more than 6 cm. long . 14. *A. laxiflora*

Pedicels of the spikelet much shorter ; panicles up to 50 cm. long :—

Spikelets pale with nerves conspicuous, green, not more than 3·5 mm. long, quite glabrous or with a few bristles on the back of the glumes ; panicle very variable up to 20 cm. long . 18. *A. metzii*

Spikelets 3·5–4·5 mm. long, almost glabrous but at least with a few cilia on the keel of the upper glume, or showing the tubercle bases of the fallen bristles ; panicle 6–30 cm. long, lower glume 2·5–3, upper 3·5–4 mm. long . 18. *A. metzii*

Spikelets very bristly from tubercled-based hairs on the nerves of the glumes and/or on the interspaces, or at least the bases of the bristles remaining :—

Spikelets 6–7 mm. long, densely crowded on the short branches of the panicle ; perennials :—

Peduncle hairy below the inflorescence ; basal sheaths very long, crowded at the base of the culm 19. *A. vaginata*

Peduncle glabrous below the inflorescence ; basal sheaths much shorter . . . . 20. *A. hookeri*

Spikelets up to 5 mm. long ; annuals :—

Panicle up to 50 cm. long, very effuse and drooping ; with long branches ; spikelets 3–4 long ; glumes unequal . . . . . 18. *A. metzii*

Panicle usually compact, if rather effuse then with the glumes more or less equal :—

Lower glume considerably exceeding the lower lemma in the spikelet ; glumes very densely covered in the lower half with tubercle-based bristles :—

Panicle very dense, linear or rather open 21. *A. ciliata*

Lower glume aristulate, a little shorter than, equal to or slightly exceeding the lower lemma in the spikelet :—

Leaves rounded at the base ; spikelets 4·5–5 mm. long . . . . . 22. *A. birmanica*

Leaves not rounded at the base ; spikelets 3·5 mm. long . . . . . 23. *A. holcoides*

1. **Arundinella spicata** *Dalz.* in Dalz. et Gibs., Bomb. Flor. 293 (1861).

An annual grass. *Culms* erect or decumbent, rooting at the lower nodes, up to 30 cm. tall, very slender, long-exserted from the topmost leaf, simple, striate, scabrid to minutely hairy below the inflorescence, smooth, glabrous and shining below. *Leaf-blades* lanceolate-acute, elliptic-acute, up to 3·8 cm. long by 6 mm. broad (fide Blatter), covered on both surfaces and on the margins with dense or sparse tubercle-based hairs, soft, green or somewhat glaucous ; *sheaths* overlapping at the base, short, striate, covered all over with tubercle-based hairs, rather loose, thickly ciliate on one margin ; *ligule* a narrow membrane, long and thickly ciliate on the upper edge.

Inflorescence a very dense cylindrical spike of crowded spikelets ; axis of the spikes rather thick, shortly hairy. Spikelets 5·5–6 mm. long, subsessile. *Lower glume* 2–3 mm. long, lanceolate-acuminate when flattened, the tip being produced into a short arista, 3-nerved, covered sparsely on the outer surface with tubercle-based hairs ; *upper glume* as long as the spikelet, lanceolate-acuminate, the distal two-thirds being very narrow, plicate and carrying the awn of the upper floret, 3-nerved, scabrid, most often quite glabrous but occasionally with a few simple hairs. *Lower floret* ♂ or empty ; *lemma* lanceolate-acute, about 2·5 mm. long, hyaline, 5-nerved ; *palea* 1·5 mm. long, hyaline. *Upper floret* ♀ ; *lemma* 1 mm. long, oblong in shape when flattened, with two rather obtuse lobes at the apex, awned between the lobes ; *palea* shorter and of same texture,

elliptic-obtuse ; *styles* 2 (?) ; *stigmas* plumose ; *stamens* 3 ; *anthers* 0·25 mm. long ; *grain* not seen ; *awn* 5–6 mm. long ; column chestnut-brown, 3 mm. long, twisted.

Ind. Or. : Bombay, Mahableshwar, *T. Cooke* ; *W. A. Talbot* ; Panchgani : first tableland, Oct. 1920, *Blatter and Hallberg* B1287.

Arundinella spicata Dalz. was relegated in the Flora of British India to the indeterminable species by Hooker, although it had been described over thirty years before volume seven of the Flora of British India appeared. It is most strange that Hooker never saw the species as it is extremely common in Bombay.

2. **Arundinella setosa** *Trin.*, Gram. Panic. 63 (1826).

Miquelia setosa Nees, Nov. Act. Acad. Caes. Leop. Carol. Nat. Cur. **19,** Suppl. 1, 46 (1846).

Arundinella stricta Nees in Hook., Kew Journ. **2,** 102 (1850).

Berghausia barbulata Endl. in Miq., Anal. Bot. Ind. **2,** 20 (1851).

Arundinella hirsuta Nees ex Steud., Syn. Pl. Glum. 115 (1854).

A. zollingeri Steud., loc. cit. 115.

A. setifera Steud. loc. cit. 115.

A. mutica Nees ex Steud., loc. cit. 116.

Danthonia neuroelytrum Steud., loc. cit. 245.

D. luzonensis Steud., loc. cit. 245.

Arundinella capillaris Hook. f., Flor. Brit. Ind. **7,** 74 (1896).

Milium cimicinoides Roxb. ex Hook. f., Flor. Brit. Ind. **7,** 70 (1896).

Arundinella sinensis Rendle in Journ. Linn. Soc. Bot. **36,** 342 (1904).

Garnotia barbulata (Nees) Merr. in Philipp. Journ. Sci. Bot. **13,** 130 (1918).

Arundinella bidentata Keng in Journ. Wash. Acad. Sci. **21,** 159 (1931).

A perennial grass without a rhizome but with many dormant basal buds on a hard rootstock. *Culms* up to 100 cm. tall, slender to fairly stout, terete, smooth and glabrous, striate, erect or very rarely branched low down, glabrous at the nodes. *Leaf-blades* very narrow, linear, tapering to an acuminate tip, up to 25 cm. long, 5 mm. broad, very variable in the amount of indumentum present, at times almost glabrous with a very sparse pubescence consisting of short tubercle-based hairs to densely hirsute on both surfaces with similar hairs and densely ciliate along the margins ; *sheaths* clasping the culms, tight, very striate, again very variable in the extent and density of the indumentum, at times almost glabrous below and densely hairy above, at others, sparsely hairy over the whole length of the sheath ; *ligule* definitely a membrane which, when young, is densely and long-ciliate, breaking up at maturity and the cilia often caducous.

Inflorescence a drooping panicle which is extremely variable in size and density, a few centimetres up to 30 cm. long ; axis terete, striate, smooth or scaberulous below, becoming angled and sulcate above and very scabrid, almost hispid on the angles, in the upper portion much exceeded by the branches ; branches up to 15 cm. or more long, angled,

arranged alternately on the axis or almost whorled, close or distant, carrying the pedicelled spikelets which are often in pairs, one long- one short-pedicelled ; pedicels slender, angled, scaberulous, dilated below the spikelet and almost always with 1–several conspicuous bristles at or just below the tip. *Spikelets* very variable in size, 5–7 (8) mm. long, gaping, the beak of the upper glume often reflexed. *Lower glume* 3·5–5 (6) mm. long, elliptic-acuminate, almost shortly aristate, membranous becoming rather firm, 3-nerved, the nerves anastomosing at the tip, scabrid on the nerves or otherwise smooth and glabrous, or irregularly furnished with a few tubercle-based colourless hairs ; *upper glume* 5·5–7 (8) mm. long, elliptic-acuminate, the upper third contracted into a narrow beak in which the awn lies, 5-nerved, scabrid on the nerves, smooth and glabrous or furnished with several to many tubercle-based hairs. *Lower floret* ♂ or neuter ; *lemma* 3–4·5 (5·5) mm. long, chartaceous, rounded on the back, oblong-obtuse in shape, smooth and glabrous, 5-nerved, the outer two rather close together ; *palea* elliptic-obtuse, a little shorter and narrower than the lemma, 2-nerved, 2-keeled ; *stamens* 3 ; *anthers* 1·5 mm. long. *Upper floret* ♀ ; *lemma* up to 3 mm. long, with a hairy callus, becoming indurated at maturity and turning brown or black, lanceolate in outline with a stout twisted awn at the apex and two setae up to 3·5 mm. long, smooth and glabrous in the lower half but scabrid near the tip ; *palea* of the same texture ; *awn* up to 9·5 mm. long, perfect, kneed ; *column* chestnut-brown to black, twisted, 3·5 mm. long ; *stamens* 3 ; *anthers* 1·5–2 mm. long ; *styles* 2 ; *stigmas* plumose ; *hilum* ovate, small ; embryo more than half the grain.

var. **setosa**

Ind. Or. : Assam ; *Griffith* 6786 ; Khasi Hills, Boga Panee, 2 Jul. 1850, Hook. f. et T. Thoms. ; ibidem, Nunkhlow, 28 Jul. 1850, *Hook. f. et T. Thoms.* ; ibidem, Myrung, 29 Jul. 1850, *Hook. f. et T. Thoms.* ; ibidem, Ungot river, 25 Sept. 1850, *Hook. f. et T. Thoms.* ; ibidem, Myrung, 13 Oct. 1850, *Hook. f. et T. Thoms.* ; ibidem, Shillong, 1500 m., 7 Aug. 1885, *C. B. Clarke* 38577 ; ibidem, Shillong 1800 m., 16 Aug. 1885, *C. B. Clarke* 38835, 43562 ; ibidem, Jowai, 31 Aug. 1886, 1200 m., *C. B. Clarke* 44767 ; Naga Hills, Shibang, 900 m., Dec. 1907, Meebold 7496 ; Shillong, 1650 m., 7 Sept. 1943, *N. L. Bor* 17918.

Bombay ; N. Kanara, Dandeli, 630 m., 11 Jan. 1890, *W. A. Talbot* 2266.

Bihar ; Soane River, in woods, *Hook. f.* 1847 ? ; Manbhum, Jhulda, 7 Dec. 1874, 300 m., *C. B. Clarke* 25212 ; Lohardugga 600 m., 26 Oct. 1883, *C. B. Clarke* 33920 ; Singhbhum 450 m., 15 Nov. 1883, *C. B. Clarke* 34252 ; ibidem, Oct. 1899, *H. H. Haines* 235—dry hills ; Ranchi, 600 m., 9 Mar. 1901, *A. Cooke* 173 ; Ranchi, Palamau, 900 m., Oct. 1910, *H. H. Haines* 4495.

N.W. India ; Herb. *Royle* (Type of *A. hirsuta* Nees) ; Sutlej Valley near Rampore, 1847, *T. Thoms.* ; Simla, 2100 m., Sept. 1877, *J. S. Gamble* 5153 ; Tehri, Jumna Valley, 1 Sept. 1883, *J. F. Duthie* 317 ; ibidem, 2100 m., 4 Sept. 1883, *J. F. Duthie* 335 ; Kumaon, near Dolchini, 5 Oct. 1884, *J. F. Duthie* 3483 ; Garhwal, Lobah, 1500–1800 m., 23 Sept. 1885, *J. F. Duthie* 5038 ; Kumaon, 1500–1800 m., 22 Aug. 1886, *J. F. Duthie* 6135 ; near Simla, 24 Aug. 1889, *J. F. Duthie* 10104 ; Mussoorie, Sept. 1897, *J. F. Duthie* 23047 ; Tehri road below Landour, 1800–2100 m., 25 Sept. 1895, *J. F. Duthie* 17838 ; Mohand pass, Oct. 1898, *J. F. Duthie* ; Mussoorie, Baurg, 16 Sept. 1899, *J. F. Duthie* ; Kanital, Aug. 1899, *J. F. Duthie* 23407 ; Mussoorie, Landour, 2250 m., 4 Sept. 1930, *R. R. Stewart* 11409.

Madhya Pradesh ; Pachmarhi, 19 Feb. 1891, *J. F. Duthie* 10612.

Madras ; Palmacottah, 28 Oct. 1795, *Rottler* (*Andropogon capillare*) ; Nilgiris, 1851, *Hochst.* 920 (Type of *A. setifera* Steud.) ; Conoor, 1800 m., Sept. 1883, *J. S. Gamble* 12716 ; Bellary, 1886, *J. S. Gamble* ; Naduvatam 1800 m., Nov. 1888, *W. A. Lawson* ; Cuddapah, 900 m., Aug. 1889, *J. S. Gamble* 21332 ;

Pulneys. Silver Cascade. 27 May 1898, *Bourne* 1942 ; ibidem. Periya Shola, 18 Jun. 1898. *Bourne*. 3004 ; ibidem, Kodaikanal, Lidcot, 1 Jul. 1898, *Bourne* 1915 ; Ootacamund, Aug. 1899, *Bourne* ; Pulneys, Gundar Valley, 10 Jun. 1901, *Bourne* 1447 ; Ganjam, Mahendragiri, 9 April. 1904, 1260 m., *Fischer & Gage* 112—very common grass ; Santaveri Babab (sic) 1200 m., Oct. 1908. *Meebold* 10450 ; Mysore, Kumsi, 600–900 m., Oct. 1908, *Meebold* 10776 ; Tinnevelly, Naberikal, 1200 m., 12 Feb. 1913, *Hooper & Ramaswami* 38506 ; High Wavy Mountains. May 1917. *Blatter & Hallberg* 709 ; Chittur, Horsleykonda. 1200 m., 15 Sept. 1918. *Fischer* 4456 ; Pulneys. Kodaikanal, May 1921, 2100 m., *L. Anglade* 2205 ; Madura, High Wavy mountains, 6 Sept. 1925, *Cherian Jacob* 17548.

Burma : Maymyo Plateau, 1050 m., 21 Sept. 1911, *J. H. Lace* 5428 ; Amherst, Kwin below Mulayit, 1890 m., 3 Feb. 1927, *C. E. Parkinson* 5162 ; Shwe-u-daung Game Reserve, 1800 m., 25 Feb. 1930, *H. C. Smith*—Padaw myet.

Ceylon ; Trincomalee, Dec. 1885, *U.T.*

var. **lanifera** C. E. C. Fisch. in Gamble, Flor. Madras 1801 (1934).

Madras ; Cuddapah 1050 m., Aug. 1889, *J. S. Gamble* 21307 (Typus in Herb. Kew.).

This species, while it does not vary in the size of its vegetative parts to the same extent as *A. nepalensis* Trin., has in other ways given a great deal of trouble. The large spikelets are reasonably constant in shape and size and are usually supported by well-defined bristles or setae from the pedicel at or just below the tip. These bristles are not, however, always present. The upper lemma, which nearly always is decorated with a perfect awn arising at the tip between two bristles, sometimes is devoid of the bristles or both the bristles and awn. The spikelets have a characteristic look, not easy to put into words, which as a rule makes the plant easy of discrimination.

3. **Arundinella khaseana** *Nees ex Steud.*, Syn. Pl. Glum. 115 (1854).

A perennial coarsely tufted grass from a thick woody rootstock. *Culms* up to 105 cm. tall, stout, robust, terete, smooth and glabrous, or scabrid below the panicle, simple, thickly but shortly pubescent on the nodes. *Leaf-blades* up to 30 cm. long on herbarium specimens, probably twice as long on the living plant, 4–6 mm. wide in herbarium specimens, minutely scaberulous on both surfaces, scabrid on the margins, usually folded or rolled in various ways, stiff, mostly glabrous but often with a thick or sparse growth of stiff hairs from tubercle-bases in the neighbourhood of the collar on both surfaces, or rarely pubescent on both surfaces, linear-acuminate, the upper leaves hardly rounded to the base ; *sheaths*, at least the uppermost, tight, clasping, glabrous but scaberulous in the lower half, covered between the striations in the upper half with tubercle-based hairs which fall off with age, leaving the rough bases behind ; *ligule* a very narrow membrane, less than 1 mm. wide, lacerate and ciliate on the upper margin, usually backed by dense hairs on the leaf-surface.

Inflorescence a dense or comparatively open panicle up to 45 cm. long by 10 cm. wide consisting of an erect central sulcate and ridged axis which is excessively scabrid on the angles and which bears alternate, fascicled or subwhorled, ascending branches, either closely or distantly spaced ; branches simple or sparingly branched, up to 11 cm. long, angled and sulcate, scabrid on the angles, bearing densely or distantly arranged spikelets usually in pairs and seated on scabrid pedicels, usually shorter

than the spikelets. *Spikelets* 5·5–6 mm. long, dark purple in colour, bristly. *Lower glume* 4–4·5 mm. long, elliptic-acuminate in shape, the upper quarter much compressed, 5-nerved, scabrid on the nerves and with a few stout tubercle-based bristles on the dorsal surface ; *upper glume* 5·5 mm. long, ovate-acuminate, 5-nerved, compressed towards the tip, scabrid on the nerves, with a few tubercle-based bristles on the dorsal surface. *Lower floret* ♂ ; *lemma* shape of and almost as long as the upper glume but more delicate and not so strongly suffused with purple, 2-nerved, glabrous and smooth on the dorsal surface ; *palea* lanceolate, 3·5 mm. long, obtuse or notched at the tip, hyaline, 2-keeled, smooth and glabrous ; *stamens* 3 ; *anthers* 1·5 mm. long. *Upper floret* ♀ ; *lemma* with a bearded callus, 2 mm. long, hyaline, smooth and glabrous except for a slight scabridity towards the top, 5-nerved, the two lateral on each side anastomosing and carried out as short, scabrid bristles, between which issues the stout awn ; *palea* of same texture, 2-nerved, 2-keeled, flaps expanded below ; *styles* 2 ; *stigmas* plumose ; *stamens* 3 ; *anthers* 2 mm. long ; *awn* 5–6 mm. long ; *column* 2 mm. long, chestnut-brown, twisted.

Ind. Or. : Khasi Hills : Khasiya, *Griffith* : ibidem, Kalapanee 26 Jun. 1850, *Hook. f. & T. Thoms.* : Mynung, 30 Jul. 1850, *Hook. f. et T. Thoms* ; Sohra 1350 m., 28 Oct. 1887, *C. B. Clarke* 36406 ; Shillong, 1800 m., 16 Aug. 1885, *C. B. Clarke* 38828A & B ; Sohrung, 1500 m., 12 Sept. 1886, *C. B. Clarke* 44726D ; **Jugum, Khasea, *Wallich* 8672. (Typus in Herb. Kew.).**

Naga Hills : Kohima, 1500 m., 20 Aug. 1935, *N. L. Bor* 5328 ; ibidem, Bopungwemi, 1200 m., 9 Sept. 1935, *N. L. Bor* 6476.

Wallich 8672 is quoted by Steudel in Syn. Pl. Glum. 115 (1854) as the plant in Wallich's Herbarium upon which the species was based by Nees. As Nees' herbarium has been completely destroyed, I select the cotype of the species preserved in the Kew Herbarium as the type.

4. **Arundinella mesophylla** *Nees ex Steud.*, Syn. Pl. Glum. 115 (1854).

An annual grass. *Culms* often very many from the base and then markedly decumbent or erect and few, often branched from the lower nodes, terete, smooth and glabrous, even at the nodes, striate, up to 45 cm. tall. *Leaf-blades* linear-acuminate, up to 10 cm. long, 4–6 mm. wide, tapering towards the base or rounded to the sheath, closely many-nerved, sparsely or densely covered on both surfaces with tubercle-based hairs, ciliate on the scaberulous margins with similar hairs, hairs very dense behind the ligule ; *sheaths* tight towards the top, clasping, striate, those lower down inclined to slip from the clums, glabrous or sparsely hairy with tubercle-based hairs on the lower third, with the hairs increasing in density from below upwards and often very densely hairy towards the collar ; *ligule* membranous, 1 mm. wide, densely ciliate on the lacerate upper margin.

Inflorescence a somewhat dense panicle almost 7 cm. long, 2 cm. wide, consisting of an angled and sulcate somewhat flexuous axis, hirsute with tubercle-based hairs or almost glabrous, with several raceme-like branches ; branches up to 1·8 cm. long, straight, glabrous or hirsute similar to the axis, carrying usually densely crowded spikelets in pairs ; spikelets shorter than the pedicels. *Spikelets* 5–5·5 mm. long, gaping at anthesis. *Lower glume* 4 mm. long, lanceolate-acuminate, almost aristulate, 3-nerved, the nerves joining towards the apex, with tubercle-based hairs on the scabrid nerves, otherwise smooth and glabrous, or more usually

with a dense covering of short tuberculate-based hairs between the lateral nerves and the margins ; *upper glume* 5·5 mm. long, lanceolate-acuminate when flattened, the upper half tapering to a bifid or blunt tip, 5-nerved, covered with tubercle-based hairs on the nerves, otherwise smooth and glabrous, or hairy as in lower glume. *Lower floret* ♂ ; *lemma* 2·5 mm. long, hyaline to sub-chartaceous, elliptic in shape when flattened, 3-nerved, the two lateral very broad, smooth and glabrous ; *palea* 2 mm. long, 2-nerved, 2-keeled, oblong-obtuse ; *stamens* 3 ; *anthers* 0·5–1·75 mm. long. *Upper floret* ♀ ; *lemma* with a shortly bearded callus, 1·5–1·75 mm. long, oblong-elliptic, hyaline becoming indurated and brown in colour, glabrous and smooth below, coarsely scabrid above, 3-awned, the two lateral 2·5 mm. long, filiform, the median 6 mm. long with a twisted brown column 3 mm. long ; *palea* same texture as the lemma ; *stamens* 3 ; *anthers* 1–1·25 mm. long ; *styles* 2 ; *stigmas* plumose.

Ind. Or. : Madras ; Wallich's 8663B ex Herb. Wight. (Typus in Herb. Kew.) ; Pulney Mountains *Wight* 1836 ; Travancore, Jun. 1835 *Wight* ; Nagercoil, 24 Dec. 1894, *M. A. Lawson* 231 ; Pillar Rocks, 19 Jul. 1895 *Bourne*; Kodaikanal Waterfall, 1 May 1899, *Bourne* ; Jesmond Hill, 9 Jul. 1899 ; Villimalai-Anaimalai Hills, 1050 m., 25 Oct. 1913, *C. E. C. Fischer* 3650 ; Travancore, Vendamattu, 1500 m., Dec. 1910, *Meebold* 13068 ; Upper Palnis 2160 m., 19 Aug. 1911, *C. E. C. Fischer* 2878 ; Malabar, Palghat, 30 Dec.1919, Madras Herb. 16344.

This very distinct species could hardly be mistaken for anything else.

5. **Arundinella tuberculata** *Munro ex Lisboa* in Journ. Nat. Hist. Soc. Bomb. **5,** 344 (1891).

An annual grass. *Culms* several from the base which is sometimes decumbent, usually erect, simple, up to 80 cm. tall, terete, smooth and glabrous, bearded at the nodes with downwardly directed tubercle-based hairs. *Leaf-blades* oblong-acuminate or narrowly elliptic-oblong-acuminate, tapering towards the base and slightly rounded to the sheath, up to 12 cm. long by 11 mm. wide, hispid on both surfaces with colourless longish hairs from small tubercle-bases, ciliate all along the margins with similar hairs, minutely scaberulous with a stout midrib on the lower surface which is carried down on the sheath as a keel ; *sheaths* tight, clasping, very striate, covered all over with colourless tubercle-based hairs which are more numerous in the upper half and are sometimes almost absent in the lower half ; *ligule* a membranous ring, densely and shortly ciliate on the upper margin.

Inflorescence a narrow panicle up to 14 cm. long, 3 cm. wide, consisting of a flexuous sharply-angled axis densely and coarsely scabrid on the angles ; branches similar, alternate, distant or several together carrying bristly spikelets in pairs, one long- one short-pedicelled, or of one of a pair aborted. *Spikelets* 8–9 mm. long, gaping at anthesis. *Lower glume* 5 mm. long, ovate-acute, produced at the tip into a short arista, 3-nerved, scabrid on the nerves and furnished on the nerves with stout colourless tubercle-based hairs ; *upper glume* 8–9 mm. long, lanceolate-acute in the lower half with the upper half produced into a blunt beak, 5-nerved, with nerves decorated with similar hairs. *Lower floret* ♂ ; *lemma* hyaline, elliptic-acute when flattened, 4·5 mm. long, smooth, glabrous, shining ; *palea* 3·5 mm. long, hyaline, elliptic-acute, 2-keeled ; *stamens* 3 ; *anthers* 2 mm. long. *Upper floret* ♀ ; callus bearded ; *lemma* 2·5 mm.

long, elliptic-oblong in shape, chartaceous, glabrous below, scabrid above, with two very slender setae at the tip and a rather stouter awn which is 9 mm. long, with a brown twisted column 4·5 mm. long ; *palea* elliptic in shape, of the same texture as the lemma, scabrid on the adaxial surface, 2-nerved and 2-keeled ; *stamens* 3 ; *anthers* 3 mm. long ; *styles* 2 ; *stigmas* plumose.

Ind. Or. : Madras ; *Stocks* : Deccan, May 1880, *Woodrow*.
Madhya Pradesh ; 1868, *G. King*.

The long spikelets, together with the sheaths and leaves, covered with longish tubercle-based hairs, distinguish the species at a glance. It seems to be comparatively rare, judging from the frequency of the gatherings, and appears to be confined to the hotter and drier parts of the Concan and Central India.

6. **A. nervosa** (*Roxb.*) *Nees ex Hook. & Arn.*, Bot. Beechey Voy. 237 (1836).

Holcus nervosus Roxb., Flor. Ind. **1,** 320 (1820).

An annual grass. Culms varying greatly in height, from 15 cm. to over 80 cm. tall, often many from the base, at other times solitary, usually unbranched, terete, striate, smooth and glabrous, even at the nodes and below the panicle, often rooting from the lower nodes. *Leaf-blades* up to 24 cm. long, 7 mm. wide, linear-acuminate, rounded to the sheath at the base, very variable in the amount of indumentum, from almost glabrous to densely covered on both surfaces with short tubercle-based hairs ; *sheaths* on the upper part of the culm tight, clasping, those lower down inclined to slip from the culm, from almost glabrous to densely hairy in the upper half and sparsely hairy in the lower half ; *ligule* a narrow membrane with an irregular upper margin.

Inflorescence a panicle very variable in size from 6 cm. to 25 cm. long, erect or drooping ; axis terete below, angled and sulcate above, extremely scabrid on the angles ; branches branching and rebranching, arrayed in fascicles or alternate on the axis, very scabrid on the angles ; pedicels with a few white bristles below the spikelet. *Spikelets* 5–6 mm. long, gaping at anthesis, in secund pairs on the branches. *Lower glume* 3·5 mm. long, ovate-acuminate, shortly aristate, 3-nerved, scabrid and bristly on the nerves from tubercle-based bristles or glabrous ; *upper glume* about 6 mm. long, elliptic-acute in the lower half with upper half much narrowed into a plicate beak in which the awn lies before anthesis, 5-nerved, scabrid and bristly or glabrous on the nerves with tubercle-based bristles. *Lower floret* ♂ or neuter ; *lemma* 3·5 mm. long, hyaline-sub-chartaceous in texture, rounded on the back, elliptic-obtuse in shape when flattened, 3-nerved with lateral nerves rather broad ; *palea* oblong-acute, 3 mm. long, 2-nerved and keeled ; *stamens* when present 3 ; *anthers* 1·25 mm. long. *Upper floret* ♀ ; *lemma* with a shortly and sparsely bearded callus, narrowly oblong-elliptic, 2·5 mm. long, glabrous in the lower half, coarsely scabrid at the apex, milky in colour or brownish at maturity, chartaceous, 3-awned at the tip, the two lateral filiform about 2 mm. long, the central perfect 5–9 mm. long, the lower 2–4 mm. being a twisted chestnut coloured column, rather slender ; *stamens* 3 ; *anthers* 1·4 mm. long ; *styles* 2 ; *stigmas* plumose.

Ind. Or. : Bombay ; Siddharpur, Oct. 1919, 480 m., *L. J. Sedgwick* 7253—laterite flats—rainfall 100 ins.

Madras : Wight Cat. 1669b, 2387 ; Palmacottah, Dec. 1838, *Wight* 1315 ; *Wight* 3242 ; *Wallich* 8665 ; Mysore, Ananthapura, 600–900 m., Oct. 1908, *Meebold* 10456 ; Pulneys, Kodaikanal Ghat, 31 May 1898, *Bourne* ; ibidem, 11 Dec. 1898, *Bourne* 1914 ; ibidem 13 Dec. 1898, *Bourne* 3005 ; Tinnevelly, Mundanthorai Ghat, 14 May 1901, *C. A. Barber* 2775 ; Tinnevelly, Courtallam, 11 Nov. 1908 *Bourne* 5304 ; Hosur, Salem Dist., 29 Dec. 1916, *Bourne* ?

Several references to this plant have been made in the preceding pages, occasioned by the similarity of the spikelets to those of *A. setosa* Trin.

There is a most excellent figure of this plant in the collection of Roxburgh's drawings in the Kew Herbarium, which leaves no doubt of the identity of his *Holcus nervosus*.

7. **Arundinella villosa** *Arn. ex Steud.*, Syn. Pl. Glum. 115 (1854).

A. villosa Arn. ex Steud. var. *Wightii* Hook. f., Flor. Brit. Ind. **7,** 73 (1896).

A perennial grass with a hard woody base clothed below with short sheaths which are covered with a dense curly pale yellow wool. *Culms* up to 60 cm. tall, glabrous or very slightly pubescent below the panicle or minutely scaberulous, terete, somewhat striate. *Leaf-blades* up to 45 cm. long, 5 mm. wide, flat, involute or rolled, linear-acuminate in shape, densely covered on both surfaces with colourless hairs from tubercle-base or quite glabrous, tapering to a capillary tip ; *sheaths* of two kinds, the upper up to 12 cm. long, clasping the culm, smooth and glabrous, shining, with a very short leaf, the lower short up to 5 cm. long, carrying a long leaf, loose, slipping from the culm, sparsely villous from tubercle-based hairs and densely covered at the base with pale yellow crisp curly wool ; *ligule* a very narrow membrane.

Inflorescence a strict panicle consisting of a central axis upon which is arranged alternately, a series of short densely spiculate racemes ; axis straight or flexuous, terete between the lowest node, which carries a rudiment of a raceme, and the first true raceme, above the latter angled, densely pubescent and scabrid on the angles and surface ; racemes 2·5 cm. or less long, alternate, rarely two at a node, consisting of a villous rhachis upon which the spikelets are arranged in pairs. *Spikelets* 7 mm. long. *Lower glume* 5–6 mm. long, elliptic-acuminate when flattened, with the tip almost aristulate, 3–5-nerved, very bristly on the nerves or between, with tubercle-based hairs 2·5 mm. long, sometimes hirsute between the lateral nerves and the margins ; *upper glume* 6–6·5 mm. long, elliptic-acuminate, the upper third forming a stout beak, 5–7-nerved, the lateral nerves with similar tubercle-based bristles, which are also found on the surfaces between. *Lower floret* ♂ or neuter ; *lemma* 5 mm. long, oblong-acute when flattened, very smooth and glabrous, 5-nerved with the two lateral close together ; *palea* 3·5–4 mm. long, 2-keeled ; *stamens* 3 ; *anthers* 1 mm. long. *Upper floret* ♀ ; *lemma* 2·5 mm. long, shortly bearded on the callus, chartaceous, oblong, scabrid on the dorsal surface in the upper third ; *palea* 2-keeled, a little longer ; *stamens* 3 ; *anthers* 2 mm. long ; *styles* 2 ; *stigmas* plumose ; *awn* 6 mm. long ; *column* 2·5 mm. long, chestnut-brown, twisted.

IND. OR. : Ceylon ; Herb. Wight no. 2037 (type of *A. villosa* Arn.) ; *Gardner* 997 ; Pupuressa, 1 Nov. 1931, *N. D. Simpson* 8759—bank of roadside stream ; Uva Province, Rendapola on Badulla road below Hakgala, 1590 m., 25 Dec. 1950, *F. Ballard* 1223—rock crevices in roadside cliff, large tufted grass ; Corbetts Gap, 1200 m., 7 Jan. 1951, *F. Ballard* 1404—on high bank by roadside ; large tufted grass.

This endemic species is distinguished from all others in the area under consideration by the development of crisp wool at the base of the plant. *A. hookeri* Munro ex Keng and *A. vaginata* Bor were considered by Hooker to be synonymous with it, but there can be no doubt whatever that they are better kept apart. Occupying, as they do, elevated habitats in widely separated localities, they must have had an independent existence for many scores of thousands of years.

8. **Arundinella decempedalis** (*O. Ktze.*) *Janowsky* in Fedde, Rep. Sp. Nov. **17,** 84 (1921).

Panicum decempedale O. Ktze., Rev. Gen. Pl. 783 (1891).

Arundinella clarkei Hook. f., Flor. Brit. Ind. **7,** 75 (1896).

A perennial grass from a stout woody rootstock which emits thick rhizomes covered with coriaceous overlapping scales. *Culms* up to 3 m. tall and more, stout, woody, simple, terete, minutely scabrid below the panicle, otherwise smooth and glabrous save for the nodes which are densely covered with a white shining appressed pubescence. *Leaf-blades* 1 m. or more in length, up to 3 cm. wide, linear, tapering to a long acuminate tip, smooth and glabrous on both surfaces or more often covered sparsely with rather short tubercle-based hairs to densely hairy behind the very short ligule, coarsely scabrid on both surfaces or smooth, very scabrid on the margins and the adjacent nerves, tapering to the base, with a very broad white midrib on the upper surface ; *sheaths* clasping the stem, loose below, very firm, striate, usually glabrous but becoming densely hirsute at the collar ; *ligule* a membrane less than 1 mm. wide which is very shortly ciliate on the upper margin.

Inflorescence a gigantic erect panicle up to 50 cm. long by 15 cm. wide, consisting of a very stout central, sulcate, glabrous, scaberulous, angled axis upon which the spikelet-bearing branches are arranged in distant whorls ; branches hirsute at the junction with the axis, ascending, up to 15 cm. or more long, scabrid, ridged, rarely branching ; pedicels longer or shorter than the spikelets, slightly dilated at the apices, scabrid and often with a few short hairs below the spikelet. *Spikelets* 3·5–4 mm. long, pale, gaping, usually shortly awned. *Lower glume* 2·5–3 mm. long, lanceolate-acute, strongly 3-nerved, very scabrid on the nerves, otherwise smooth and glabrous ; *upper glume* 3·25–3·5 mm. long, lanceolate-acute, 3-nerved, smooth and glabrous. *Lower floret* ♂ or neuter ; *lemma* elliptic- or oblong-obtuse, chartaceous, 3-nerved, 2·5 mm. long, smooth and glabrous ; *palea* lanceolate, 2-keeled, hyaline ; *stamens* if present 3 ; *anthers* 1 mm. long. *Upper floret* ♀ ; *lemma* 2 mm. long, finally indurated and brown in colour, lanceolate-acute in outline, with a short bearded callus, smooth and glabrous or minutely scabrid above ; *palea* of the same texture and colour ; *stamens* 3 ; *anthers* 1·25–1·5 mm. long ; *styles* 2 ; *stigmas* plumose ; *hilum* punctiform ; *embryo* more than half the length of the grain ; *awn* perfect, often present, if so 2–4 mm. long ; *column* twisted, chestnut-brown 1–2 mm. long.

Ind. Or. : Bengal ; Sikkim Terai, in the jungle between Goreedora and Kuparil, 26 Oct. 1868, *S. Kurz* ; Darjeeling Terai, 150 m., 2 Dec. 1875, *C. B. Clarke* 26483 (Type of *Arundinella clarkei* Hook. f.) ; Sikkim, Bamunpokri, 300 m., Nov. 1879, *J. S. Gamble* 7401 ; Dulkajhar, 150 m., 16 Oct. 1884, C. B. Clarke 36758A ; West Duars, Oct. 1895, *H. H. Haines* 565.
Assam ; Goalpara, 25 May 1912, *R. S. Hole*.

This colossal species, so far as is known to the writer, is found only in the plains of Bengal and Assam, north of the Brahmaputra river. Owing to the enormous size of its panicle of mostly unawned spikelets, it is hardly likely to be mistaken for any other species. The spikelets are often awned with a short awn which can be divided into twisted column and bristle. In the Naga Hills the panicles of *A. nepalensis* Trin. approach those of *A. decempedalis* in size.

This species has a most extensive root system in which thick meandering rhizomes, covered with thick scales, play a conspicuous part.

9. **Arundinella leptochloa** (*Nees ex Steud.*) *Hook. f.*, Flor. Brit. Ind. **7,** 76 (1896).

Panicum leptochloa Nees ex Steud., Syn. Pl. Glum. 62 (1854).

Arundinella gigantea Dalz. in Dalz. et Gibs., Bomb. Flor. 293 (1861).

Panicum zeylanicum Arn. ex Hook. f., Flor. Brit. Ind. **7,** 76 (1896) nomen.

Arundinella lawsonii Hook. f., Flor. Brit. Ind. **7,** 76 (1896).

A tall perennial grass. *Culms* up to 2 m. (fide Hook. f.) terete, smooth and glabrous, even at the nodes, simple, striate. *Leaf-blades* a few centimetres up to 60 cm. long, 4 mm. to 3·5 cm. broad, linear-lanceolate, tapering to a fine acuminate scabrid tip, rounded or almost cordate at the base in the large and broad leaves, scabrid on the margins, glabrous but usually with a few tubercle-based hairs towards the base which are often dense behind the ligule, smooth on both surfaces ; *sheaths* tightly clasping the stems above, very striate, usually with a sparse covering of tubercle-based hairs ; *ligule* a very narrow membrane.

Inflorescence a panicle, very variable in length and breadth and density, up to 45 cm. long by 20 cm. wide, with spaced spreading branches or very short and dense and flabellate with closely ascending branches thickly crowded with spikelets, consisting of an erect central scabrid angled axis upon which are arranged a series of parallel ascending branches up to 15 cm. long, carrying densely crowded spikelets ; branches often subwhorled with a tuft of white hairs at the junction with the axis. *Spikelets* 2·5–3·5 mm. long, rather squat and turgid, often suffused with purple. *Lower glume* 2 mm. long, broadly ovate-acute, smooth and glabrous except on the scabrid nerves ; *upper glume* 2·5–3 mm. long, extremely broadly ovate-acute, 5-nerved, smooth and glabrous except on the scabrid nerves. *Lower floret* neuter, ♂ or ♀ ; *lemma* broadly elliptic-acute, hyaline, 5-nerved with the two outer nerves rather close together, smooth and glabrous ; *palea* elliptic-oblong-obtuse, hyaline, 2-keeled ; *stamens* 3 ; *anthers* 1 mm. long. *Upper floret* ♀ ; *callus* naked ; *lemma* 1 mm. long, oblong-elliptic-obtuse, becoming chartaceous, minutely scabrid, brown when mature, unawned ; *palea* of the same texture and colour ; *styles* 2 ; *stigmas* plumose ; *stamens* 3 ; *anthers* 1 mm. long ; *caryopsis* about 1 mm. long ; *embryo* half the length of the grain.

Ind. Or. : Bombay ; ex Herb. Munro ; Belgaum, 15 Jan. 1915, *R. S. Hole* ; N. Kanara, Yellapur, 600 m., Nov. 1919, *Sedgwick* 3469 ; Concan, *Stocks* (type of *A. gigantea* Dalz.).

Madras ; Herb. Rottl. (Typus in Herb. Kew.) ; Herb. Wight 1621, 3205 ; Nilambur, 18 Nov. 1888, *M. A. Lawson* 50—wet open places ; North Malabar, Badagara 28 Oct. 1900, *Bourne* ; Tinnevelly Dist., Sengalteri, 24 Sept. 1915, Madras Herb. 12450 ; Travancore, *V. Narayanaswami* 1392 and 1743. Cochin, *Johnstone* (Typus of *A. leptochloa* var. *gracillima* Hook. f.) ; Malabar, June 1836, *Wight* 1332 ; Goodaloor, 900 m., 15 Nov. 1888, *M. A. Lawson* 12—swamps (Typus of *A. lawsonii* Hook. f.) ; Nilgiris, Devala, 900 m., Nov. 1884, *J. S. Gamble* 15079 ; Nilgiri Wynaad, Benne, 840 m., 21 Sept. 1920, *C. E. C. Fischer* 4489—in swamps.

The above cited sheets are those in Kew Herbarium. There is a fine series of sheets in the Blatter Herbarium at Bombay which I have been privileged to see. These sheets, with the above, form a complete series from the narrow-leaved, slender open panicle of *A. leptochloa* through the more robust and broader leaves of *A. lawsonii* to the very broad-leaved and open or closed panicle of *A. gigantea* Dalz. The size and shape of the spikelets vary only within specific limits.

Hooker erected a variety of *A. leptochloa* calling it var. *gracillima*. There is no point in keeping up this variety in such a variable species.

10. **Arundinella blephariphylla** *Trim. ex Hook. f.*, Flor. Brit. Ind. **7,** 77 (1896).

Panicum blephariphyllum Trim. in Lond. Journ. Bot. **22,** 272 (1885).

An annual grass. *Culms* up to 60 cm. tall, erect, simple, terete, sparsely hairy with tubercle-based hairs below the panicle, smooth and glabrous elsewhere even at the nodes. *Leaf-blades* rounded at the base to the sheath, tapering gradually to the acuminate tip, very thin, smooth and glabrous on both surfaces but decorated on the margin with a fringe of hairs from rather stout tubercles, up to 35 cm. long, 2·5 cm. broad, chaffy in texture, nervation obscure ; *sheaths* below smooth, glabrous, shining, thin, those above sparsely hairy with hairs from tubercle bases ; *ligule* nearly absent, an obscure membranous ring.

Inflorescence flabellate or oblong with eventually widely spreading branches consisting of a central erect axis, angled and sulcate, scabrid on the angles ; the undivided branches are arranged alternately at the top of the panicle, but tend to be subwhorled or fascicled lower down. *Spikelets* 3·5 mm. long, gaping. *Lower glume* 2·5 mm. long, elliptic-acute, when flattened, 3-nerved, smooth and glabrous on the dorsal surface but scabrid on the nerves, especially towards the tip, suffused with purple ; *upper glume* very broadly elliptic-acuminate, 5-nerved, smooth and glabrous except on the nerves, which are scabrid. *Lower floret* ♂ or neuter ; *lemma* 2·75 mm. long, rounded on the back, boat-shaped, 3-nerved, very smooth and glabrous ; *palea* elliptic obtuse in outline, 2-keeled ; *stamens* 3 ; *anthers* 1–1·2 mm. long. *Upper floret* ♀ ; *lemma* 1·75 mm. long, brown at maturity, oblong-obtuse, not awned, with a glabrous callus, minutely scaberulous ; *palea* oblong-elliptic-obtuse with a decoration of stout, almost papillose, hairs on the adaxiel surface in the upper-half (cf. *Jansenella*) ; *styles* 2 ; *stigmas* plumose ; *stamens* 3 ; *anthers* 1–1·2 mm. long.

Ind. Or. : Ceylon, Runawelle, Nov. 1883, *Trimen.*

This appears to be the only collection of this interesting grass. The very stout thick-walled hairs on the palea recall those of the palea of the upper floret of *Jansenella griffithiana*. I am not at all convinced that this species will stand the test of time. In my opinion it will eventually join the rest of so-called species which make up the synonymy of *Arundinella leptochloa* (Nees ex Steud.) Hook. f. The only collection, however, seems to indicate that it is an annual.

11. **Arundinella bengalensis** (*Spreng.*) *Druce* in Rep. Bot. Exchng. Club, Brit. Isles, 605 (1916).

Panicum bengalense Sprengel, Syn. **1,** 311 (1825).

Arundinella wallichii Nees ex Steud., Syn. Pl. Glum. 114 (1854).

Panicum strictum Roxb., Flor. Ind. **1,** 303 (1820) non R. Br. (1810) nec Pursh. (1814) nec Bosc ex Roem. et Schult. (1817).

Arundinella stricta (Roxb.) Janowsky in Fedde, Repert. Sp. Nov. **17,** 84 (1921).

A perennial grass from a stout often woody rhizome covered with silky scales. Culms up to 2 m. tall, most often erect, occasionally shortly decumbent at the base, smooth and glabrous below the panicle, simple or rarely branched below, terete, glabrous at the nodes or thickly bearded. *Leaf-blades* extremely variable in length and width, up to 60 cm. long, 20 mm. wide, linear-acuminate, rounded at the base to the sheath, attenuate to a long acuminate point, in the short plants more or less collected at the base, in the taller evenly distributed along the culms, with a well-marked midrib, covered on both surfaces with an indumentum of short tubercle-based hairs, which is extremely variable in amount, from sparse to dense, scabrid and often thickly ciliate on the margins ; *sheaths* particularly the uppermost, tight, clasping, the lower inclined to slip from the culm, leathery, striate, sparsely to thickly covered with tubercle-based hairs, densely ciliate along one margin ; *ligule* a very narrow membrane, uneven on the upper margin.

Inflorescence a very dense, erect, contracted panicle, up to 30 cm. long, 2–3 cm. (or more) broad, consisting of a central sulcate and grooved axis, which is almost smooth to almost hispid on the angles ; axis carrying short, alternate, rarely whorled, ascending (rarely spreading) branches flowering to the base, (1–2·5 cm. (5) long), which are scabrid or hispid on the angles, carrying secund spikelets in pairs on pedicels which are shorter than the spikelets. *Spikelets* 2·5–3·5 mm. long, gaping at maturity, very shortly awned or unawned. *Lower glume* 2–2·75 mm. long, 3–5-nerved, oblong-elliptic-acute when flattened, spinously scabrid on the nerves, otherwise smooth and glabrous or with a few tubercle-based hairs on or between the lateral nerves ; *upper glume* 2·3–3·5 mm. long, elliptic-acute or -acuminate, compressed in the upper quarter, 5-nerved, scaberulous or smooth on the nerves, glabrous or with a few tubercle-based hairs on the nerves or between them. *Lower floret* ♂ or neuter ; *lemma* 2·5–3 mm. long, lanceolate-acute in shape, hyaline-chartaceous, absolutely smooth and glabrous, translucent, 5-nerved, the outer two very close together ; *palea* lanceolate-acute in outline, 2-keeled, with flaps widened at the base ; stamens 3 ; anthers 1–1·25 mm. long. *Upper floret* ♀ ;

lemma 2 mm. long, unawned or with a rudimentary awn, oblong-acute, chartaceous, 3-nerved, becoming somewhat indurated at maturity, glabrous, minutely scaberulous in the upper third, with a short sparsely bearded callus ; stamens 3 ; anthers 1·5 mm. long ; *styles* 2 ; stigmas plumose ; awn, when present, often perfect with a twisted chestnut-coloured column 1 mm. long, with a bristle the same length.

Ind. Or. : Assam ; Silhet, de Silva, *Wallich* 8669 (Type of *Arundinella wallichii* Nees ex Steud.) ; Khasia, Nunklow 11 Jul. 1850, *Hook. f. et T. Thoms.* ; Myrung, 17 Oct. 1850, *Hook. f. et T. Thoms.* ; Theria 450 m., 19 Oct. 1871, *C. B. Clarke* 15506 ; Khasia, Shillong, 1950 m., 19 Oct. 1872, *C. B. Clarke* 18656 ; Mao-lingkaden, 1200 m., 2 Sept. 1886, *C. B. Clarke* 44803 ; N. Cachar Hills, Haflong, 750 m., 5 Aug. 1905, *W. G. Craib* 167 ; Lohit Valley, 1350 m., 3 Aug. 1950, *Kingdon-Ward* 20100.

Bengal, Sikkim ; Wallich 6789, 8700 ; Sikkim Terai *J. D. Hooker* ; Runjeet, 330 m., 22 Aug. 1875, *C. B. Clarke* 27128 ; Bamunpakri, 300 m., Nov. 1879, *J. S. Gamble* 7404 ; ibidem, Aug. 1880, *J. S. Gamble* 8326 ; ibidem, Aug. 1881, *J. S. Gamble* 9730 ; Calcutta, 31 Aug. 1884, *C. B. Clarke* 35801A ; West Duars, Jalpaiguri, Aug. 1895, *H. H. Haines* 543 ; Purnea, July 1932, *Wenger* 14.

N.W. India ; Dehra Dun, Jul. 1832, *J. F. Duthie* 2456 ; Kumaun, Ranikhet, 1500 m., 18 Sept. 1886, *J. F. Duthie* 6134 ; Kangra, between Dadh and Palumpur, 1200 m., 23 Sept. 1896, *G. A. Gamble* 18696 ; Dehra Dun, 660 m., Aug. 1898, *J. S. Gamble* 27144.

Bihar ; Summit of Parasnath, 900 m., 1 Oct. 1873, *C. B. Clarke* 20768.
Burma ; Shan Hills, Koni, 1320 m., Aug. 1888, *H. Collett* ; Maymyo Plateau, 1050 m., 29 Aug. 1908, J. H. Lace 4242 ; Hmawbisakhan, 3 Jul. 1947, U Thein Lwin—Burmese name—Padat-myet.

This is one of the commonest species in the plains and low hills of north and north-east India, and shows the same wide variation in indumentum, size of the vegetative parts and panicle as in most species of *Arundinella*. The spikelets are usually unawned, but some spikelets in each panicle often display a rather weak awn, which can be divided into a very short column which twists, and an even shorter bristle. The lower sheaths of some specimens are covered with a shaggy pubescence, while others are quite glabrous. The habit of the plant, however, is very regular, and the dense panicle with its ascending short branches covered with secund spikelets hardly allows for a misidentification.

12. **Arundinella thwaitesii** *Hook. f.*, Flor. Brit. Ind. **7,** 77 (1896).

An annual grass. *Culms* erect, up to 90 cm. tall, simple, slender, terete, smooth and glabrous, or hairy at the nodes. *Leaf-blades* linear-acuminate, up to 20 cm. long and 6 mm. wide, rather stiff, apparently smooth and glabrous on both surfaces apart from a sparse covering of hairs on the upper surface at the base, rounded to the sheath and often decorated on the margins by spaced tubercle-based hairs, finally rolled or plicate ; *sheaths* overlapping, tight, clasping, smooth and glabrous, finally slipping from the culms, striate ; *ligule* a narrow membrane.

Inflorescence an erect ellipsoidal panicle up to 18 cm. long by 5 cm. wide, consisting of a smooth sulcate angled rhachis on which the alternate branches carry long pedicelled spikelets ; branches often rebranching, usually naked at the base, glabrous and smooth. *Spikelets* 3·25–3·5 mm. long, very turgid. *Lower glume* 2 mm. long, almost orbicular in shape when flattened, 3-nerved, the space between the lateral and median nerve wide, smooth and glabrous on the dorsal surface, slightly scabrid on the nerves, suffused with purple; *upper glume* 3 mm. long, very broadly

elliptic- or orbicular-acute, 5-nerved, smooth and glabrous except for the minutely scaberulous nerves, suffused with purple. *Lower floret* ♂ ; *lemma* 3 mm. long, broadly ovate-acute, 3-nerved, smooth and glabrous ; *palea* oblong-elliptic-obtuse, 2-keeled with narrowly inturned flaps, hyaline. *Upper floret* ♀ ; *lemma* with a glabrous callus, 2·25 mm. long, smooth and glabrous, milky in colour, elliptic-oblong-obtuse ; *palea* of the same texture, 2-keeled, glabrous on the adaxial surface ; *styles* 2 ; *stigmas* plumose ; *stamens* 3 ; anthers 2·25 mm. long ; *awn* absent.

Ind. Or. : Ceylon, Ambayanava Dist., *Thwaites* C.P. 3782 (Typus in Herb. Kew.) ; *Thwaites* C.P. 4019.

The only species with which *A. thwaitesii* is likely to be confused is the awnless form of *A. laxiflora*. They can, however, be easily distinguished as follows. *A. thwaitesii* has a lower glume which is almost orbicular in shape when flattened as against an elliptic-acute lower glume in the other. The anthers of the upper floret are also larger, being 2·25 mm. long as against 1·5 mm. long.

13. **Arundinella pumila** (*Hochst.*) *Steud.*, Syn. Pl. Glum. 114 (1854).

Acratherum pumilum Hochst. in A. Rich., Tent. Fl. Abyss. **2,** 414 (1851).

Arundinella tenella Nees and Wight ex Steud. Nom. Bot. ed. 2, **1,** 143 (1840), nom. nud. : Steud., Syn. Pl. Glum. 115 (1854).

An annual grass. *Culms* from a few centimetres up to 60 cm. tall, very weak and decumbent, or robust and erect, terete, smooth and glabrous but hairy at the nodes with a shiny white pubescence. *Leaf-blades* broadly linear-elliptic-acute or -acuminate, varying in length from 3 cm. to 25 cm. long and from 5 mm. to 25 mm. broad, rather thin and flaccid or somewhat firm, smooth and glabrous or covered with hairs from tubercle-bases, usually scabrid on the nerves and the margins towards the tip ; *sheaths* almost always overlapping and concealing the hairy nodes, tight and clasping or slipping from the culm below, striate, smooth and glabrous or quite shaggy from numerous hairs arising from tubercles placed between the nerves, densely ciliate along one margin ; *ligule* a very narrow membrance.

Inflorescence a delicate, very effuse panicle, 4–30 cm. long, of very numerous branches and minute spikelets ; branches and branchlets ascending but spreading widely at maturity, not whorled, alternate ; axis of the panicle erect, angled, usually with a few tubercle-based hairs towards the base, glabrous upwards, angled, smooth or scaberulous below, definitely scabrid towards the tip ; branchlets capillary, scaberulous ; pedicels longer than the spikelets. *Spikelets* 2 mm. long, usually gaping. *Lower glume* 1·25 mm. long, 0·8 mm. wide when flattened, elliptic-acute, apiculate, 3-nerved, glabrous or with a few bulbous-based bristles on the nerves ; *upper glume* 1·75 mm. long, 1 mm. wide, elliptic-acuminate in shape when flattened, 3-nerved, rather pale and translucent, smooth and glabrous or with a few bulbous-based hairs from the nerves. *Lower floret* neuter or ♂ ; *lemma* 1·25 mm. long, broadly elliptic-acute when flattened, 3-nerved or often with an additional faint nerve outside the lateral nerves, smooth and glabrous ; *palea* a 2-nerved hyaline scale ; *stamens* if present 3 ; *anthers* 0·2–0·3 mm. long. *Upper floret* ♀ ; *callus* shortly pilose at the base ; *lemma* 0·6–0·9 mm. long, elliptic-obtuse, chartaceous, rather

coarsely scabrid on the dorsal surface towards the tip, entire or minutely 2-lobed at the tip, awned ; *palea* oblong-elliptic in shape, 2-keeled, as long as the lemma ; *awn* 3–3·5 mm. long ; column 1–1·5 mm. long, chestnut-brown, twisted ; *stamens* 3 ; *anthers* extremely minute, 0·1–0·3 mm. long.

Ind. Or. : Assam ; Khasi Hills, Umswai, 23 Oct. 1871, 1050 m., *C. B. Clarke* 16584E.

Bihar ; Hazaribagh, 600 m., 10 Oct. 1878, *C. B. Clarke* 21202 ; Ranchi, 600 m., 16 Oct. 1873, *C. B. Clarke* 21229B & C ; Parasnath, 1260 m., 6 Oct. 1883, *C. B. Clarke* 33670 & 33676.

Madhya Pradesh ; Mt. Abu, 1200 m., Nov. 1888, *J. S. Gamble* ; By the Prenhita, 16 Jan. 1890, *J. F. Duthie* 9914 ; Pachmarhi, Oct. 1911, *H. H. Haines* 200P ; Mt. Abu, 27 Apr. 1917, *Blatter*.

W. Himalaya ; N.W. India, *Royle* ; Dehra Dun, Rajpur, 17 Sept. 1888, *J. F. Duthie* 7693 ; Dehra Dun. 600 m., Oct. 1892, *J. F. Duthie* 23965 ; Rajpur, 900 m., Sept. 1898, *J. S. Gamble* 27236 ; Dehra, Nakund, Sept. 1899, *J. F. Duthie* 23046 ; Mussorie Road, 1350 m., 10 Sept. 1930, *R. R. Stewart* 11470.

Bombay, Khandala, 6–700 m., 19 Oct. 1893, *V. Schiffner* 1579 ; Bombay, *W. A. Talbot* ; Satara, Mwar, Oct. 1909, *W. A. Talbot* ; Igatpuri, Oct. 1917, *McCann* ; Mahableshwar, Oct. 1923, dry hill slope, with forest, under trees, *McCann*.

Madras ; Herb. Wight. (type of *A. tenella* Nees) ; Nilgiris, Naduvatam, 1500 m., Oct. 1886. *J. S. Gamble* 18304 ; Pykara waterfalls, Sept. 1898, *Bourne* ; Kodaikanal Ghat, 7 Dec. 1898, *Bourne* ; Malabar, Tellicherry, 3 Nov. 1900. *K. Rungachari* ; Kulhutty Babab, 1200–1500 m., Oct. 1908, *Meebold* 10452 ; Ghat Road, Coorg to Malabar, Oct. 1911, *C. A. Barber* 8718 ;

Ceylon ; Bibita Dist., Oct. 1925, *J. M. Silva* Madugoda, 18 Apr. 1932, *N. D. Simpson* 9464—rocks near stream ;

Burma ; Pegu Yoma, 24–26 Feb. 1871, *S. Kurz* 2798.

This extremely handsome species is easily recognised by its effuse, often very large, panicle, of very minute spikelets, and the thin papery leaves. It has a very side distribution.

14. **Arundinella laxiflora** *Hook. f.*, Flor. Brit. Ind. **7,** 75 (1896).

A. nervosa Thw., Enum. Pl. Ceyl. 362 (1864) non Nees.

An annual or subperennial grass. *Culms* many from the base, often coalescing into a hard rootstock, up to 70 cm. tall, smooth, glabrous, terete, simple, very slender, glabrous at the nodes. *Leaf-blades* linear-acuminate in shape, abruptly contracted or rounded to the sheath, flat, folded or rolled, glabrous and smooth on both surfaces, or sparsely covered on both surfaces with tubercle-based hairs, but scabrid on the margins and scaberulous at the filiform tip, up to 15 cm. long by 7 mm. broad ; *sheaths* usually tight and clasping, striate, absolutely glabrous or with a sparse covering of tubercle-based hairs ; *ligule* membranous, narrow, densely ciliate on the upper irregular margin and finally disintegrating into a row of hairs.

Inflorescence a panicle up to 6 cm. long, seated on a long-exserted glabrous and shining peduncle ; axis glabrous, angled and sulcate ; branches arising alternately with often one or two long-pedicelled spikelets at the same point of origin, glabrous, smooth, branching and rebranching, carrying long-pedicelled spikelets ; pedicels 4–5 times or more longer than the spikelets, smooth or slightly scaberulous, dilated at the apices. *Spikelets* 4·5 mm. long, gaping. *Lower glume* 3 mm. long, ovate-elliptic-acute, compressed at the tip, 3-nerved, membranous, glabrous

but scaberulous on the nerves ; *upper glume* 4·25 mm. long, broadly ovate-elliptic with the upper quarter forming a short beak, 5-nerved, scaberulous on the nerves, otherwise smooth and glabrous. *Lower floret* ♂ or neuter ; *lemma* 3 mm. long, lanceolate-acute, rounded on the back, compressed at the apex, smooth and glabrous, 3-nerved ; *palea* a little shorter, 2-nerved, 2-keeled, hyaline ; stamens 3 ; *anthers* 1·25 mm. long. *Upper floret* ♀ ; *lemma* 2 mm. long, elliptic-oblong-obtuse in shape, hyaline, becoming chartaceous, with a short bearded callus, glabrous but very minutely scaberulous on the back, notched at the apex and awned ; *palea* 2-nerved, oblong-elliptic, rather coarsely scabrid on the adaxial surface ; *awn* perfect or rarely absent, 4 mm. long ; *column* chestnut-brown 1 mm. long ; *stamens* 3 ; *anthers* 1·5 mm. long ; *styles* 2 ; *stigmas* plumose.

Ind. Or. : Ceylon ; Central Province 900–1500 m., *Thwaites* C.P. 919 (Typus in Herb. Kew.) ; *Thwaites* C.P. 3782 ; 1847, *Gardner* 1007.

This species should present no difficulty for the " look " of it is quite different from all others. One disturbing fact about it is that one of the specimens is awnless and was collected at the same time as an identical awned specimen—so much for the constancy of the character of the awn. It could not, however, be confused with any of the species which are characteristically without an awn.

15. **Arundinella nepalensis** *Trin.*, Gram. Panic. 62 (1826).

Acratherum miliaceum Link, Hort. Berol. **1,** 230 (1827).

Arundinella glabra Nees ex Hook. et Arn., Bot. Beechey Voy. 237 (1836).

A. acratherum Nees ex Steud., Nom. Bot. ed. 2, **1,** 143 (1840) nomen.

A. miliacea (Link) Nees in Hook., Journ. Bot. **2,** 102 (1850).

A. ritchei Munro ex Lisboa in Journ. Bomb. Nat. Hist. Soc. **5,** 343 (1890).

A. virgata Janowsky in Fedde, Rep. Sp. Nov. **17,** 84 (1921).

A stout perennial with a woody, widely spreading rootstock or rhizome. *Culms* almost woody, up to 3 m. tall, in unfavourable habitats very much shorter, erect from the base, rarely somewhat decumbent, simple or in certain circumstances intricately branched, terete, striate, smooth and glabrous save at the nodes which are usually strongly bearded with appressed, rarely spreading, silky pubescence. *Leaf-blades* in robust specimens up to 1 m. long, 1·5–2 cm. broad, linear, rounded at the base to the sheath, long-attenuate to a filiform scabrid tip, very variable in the amount of indumentum present, often glabrous on the surfaces save from a sparse covering of hairs at the base on the upper surface to extremely densely hirsute with short hairs from tubercle-bases either on the upper surface alone or on both surfaces, often glaucous on the lower or on both surfaces ; *sheaths* tight, clasping, smooth and glabrous, striate, or sparsely to densely covered with tubercle-based hairs, the older becoming coriaceous almost crustaceous ; *ligule* a membrane less than 1 mm. wide.

Inflorescence usually a gigantic panicle 30–45 cm. long but which, in unfavourable habitats, shrinks to a few centimetres long, erect at first then usually drooping, consisting of a central axis which is usually terete below, becoming sulcate and angled and more and more scabrid towards the tip, carrying branches which are alternate or pseudo-whorled or

fascicled ; branches up to 15 cm. long, angled, scabrid, usually simple, carrying pedicelled spikelets often arranged in pairs, one short- the other long-pedicelled ; pedicels slender, slightly dilated at the apex, never setose at the tips ; *spikelets* usually purplish, sometimes green, 3·5–4·5 mm. long, gaping at anthesis. *Lower glume* 2·5–3 mm. long, elliptic-lanceolate-acuminate, almost aristate, 3-nerved, scabrid on the nerves and keels, otherwise smooth and glabrous; *upper glume* set 0·5 mm. above the lower glume, 3–4 mm. long, 5-nerved, elliptic-acuminate, rounded on the dorsal surface, strongly compressed in the upper half or third, scabrid on the nerves and keel, otherwise smooth and glabrous. *Lower floret* ♂ or neuter ; *lemma* chartaceous, 2·5–3 mm. long, boat-shaped, rounded on the dorsal surface, 5-nerved, the outer pairs very close together, smooth and glabrous, oblong-obtuse ; *palea* elliptic-acute, 2-keeled, 2-nerved, hyaline ; *stamens* 3 ; *anthers* 1 mm. long. *Upper floret* ♀ ; *lemma* 2 mm. long, oblong-elliptic, with a short rounded bearded callus, dull white becoming brownish at maturity, scaberulous on the back at the tip ; *palea* oblong-acute, hyaline 2-nerved ; *awn* 6 mm. long, geniculate ; *column* 2 mm. long, chestnut-brown, twisted ; *stamens* 3 ; *anthers* 1·2 mm. long ; *styles* 2 ; *stigmas* plumose.

Ind. Or. : Assam ; *Griffith* 1072, 6791, and several other sheets ; Khasi Hills, Nunklow, 14 Jul. 1850, *Hook. f. et T. Thoms.* ; ibidem, towards Mahadeb, 13 Aug. 1850, *Hook. f. et T. Thoms* ; ibidem, Cherra, 15 Aug. 1850, *Hook. f. et T. Thoms.* and several other sheets ; ibidem, Shillong, 1500 m., 14 Oct. 1867, *C. B. Clarke* 5754 ; ibidem, Sohra, 1200 m., 22 Oct. 1871, *C. B. Clarke* 15653 ; ibidem, Theria, 19 Oct. 1871, 450 m., *C. B. Clarke* 15509 ; Shillong, 1200 m., 23 Oct. 1872, *C. B. Clarke* 17650 and a dozen other sheets by the same collector ; Manipur, Irang 1200–1500 m., Nov. 1907, *Meebold* 5903 ; ibidem, Kowpam, 1500 m., Nov. 1907, *Meebold* 6334 ; ibidem, Palel, 720 m., 6 Oct. 1943, *N. L. Bor* 17735—in wet grassland ; ibidem, Palel, 14 Nov. 1942, *N. L. Bor* 17100 ; Khasi Hills, Peak, 1740 m., 16 Nov. 1943, *N. L. Bor* 18073—in swampy places ; Naga Hills, Losami, 1500 m., 16 Jul. 1942, *N. L. Bor* 16017—a grass 6 ft–7 ft. tall on open burnt hillsides ; ibidem, Thevopesimi, 1500 m., 6 Aug. 1942, *N. L. Bor* 16298, and several more by the same collector in the Naga Hills.

Sikkim ; Lachoong, 2 Oct. 1849, 1800 m., *Hook. f.* ; Chukoong and Changachelling and several other sheets, *Hook. f.* 1849 ; Dumsong, 1890 m., 16 Nov. 1875, *C. B. Clarke* 26382 ; Goke, 750, 2 Oct. 1875, *C. B. Clarke* 24881; Gangtok, 1800 m., 22 Sept. 1945, Dr. Bor's collector.

Bengal Terai ; Jalpaiguri, Dec. 1893, *H. H. Haines* 419 ; ibidem, 90 m., 1898, *Dr. Hedley Wood* 173.

N.W. India ; 1848 *Wallich* 6666A. (probably the type number of *A. nepalensis* Trin.) ; Pir Pinjal and Peshawar, *Jacquemont* 1230 ; Radjaori, *Jacquemont* 1340 ; Herb. *Royle*, several sheets ; Paoree, Jun. 1845 *T. Thoms.* ; Sutlej Valley near Rampore, Aug. 1847, *T. Thoms.* ; Simla, *Madden* ; Pathankote, 450 m., 9 Sept. 1874, *C. B. Clarke* 21994 ; Dalhousie, 1800 m., 22 Sept. 1874, *C. B. Clarke* 22976 ; Chumba, 1200 m., 2 Oct. 1874, *C. B. Clarke* 24108 ; Jhelum Valley, 600–900 m., Oct. 1875, *C. B. Clarke* 27447 ; Kasumti, Simla, 1950 m., 12 Sept. 1877, *J. S. Gamble* 4948 ; Kumaon, Gori Valley 1200–1500 m., 20 Aug. 1884, *J. F. Duthie* 3566 ; Garhwal, above Lobah, 22 Sept. 1885, *J. F. Duthie* 5040 ; Dehra Dun, Sept. 1887, *J. F. Duthie* 6839 ; Hazara-Kagan, 1350 m., 20 Aug. 1889, *E. W. Trotter* 1209 ; Jaunsar, Koli Bawar, May 1891, *J. S. Gamble* 22751 ; Tehri Garhwal, Sakloa, 2100 m., May 1893, *J. S. Gamble* 24212 ; Mohand Pass, Oct. 1897, *J. F. Duthie* ; Punjab, Sakesar, 24 Aug. 1902, *J. R. Drummond* 14451 ; Uttar Pradesh, Haldwani, 19 Dec. 1911, *R. S. Hole* leg. ; Tehri, Ghunti, 1200 m., 15 Sept. 1948, *W. Koelz* 21795 ; Jammu-Kashmir road, Kao, 1500 m., 28 Aug. 1931, *R. R. Stewart* 12514.

Madras ; Pulneys, Herb. Wight, 3378 ; Deccan, May 1880, G. M. Woodrow—Type of *A. ritchei* Munro ; Pulneys, Gundar Valley, 10 Jun. 1901, *Bourne* 1448 ; Mysore, Nov. 1908, 1050 m., *Meebold* 10757 ; Travancore Muvathapuzha, Dec. 1933, *Mayuranathan*.
Bombay ; North Canara, Lisboa.

Burma ; Rangoon, 10 Jan. 1850, *Dr. McClelland* ; Maymyo Plateau 1050 m., 9 Oct. 1908, *J. H. Lace* 4290 ; Tongdong, Nov. 1826, *Wallich* 8667.

The variation in size of the vegetative parts exhibited by this species is so fantastic that, were it not for the comparative regularity in the shape and size of the spikelets, one would, in despair, give up hope of dealing with it in a rational manner. One has to accept the fact that the species responds extremely readily to changes in habitat and it is safe to speculate that in this species, sensu lato, we have possibly a polyploid series corresponding to the state of affairs in *Poa pratensis* Linn. The height of the plants varies from a few centimetres to several metres, the thickness of the culms from several millimetres to one centimetre, the panicle varies in length from a few centimetres to half a metre, the spikelets are green, brown or purple, dense or sparse on the branches, and let it be remembered that all combinations of these and intermediates between them occur.

The species reaches its greatest luxuriance in the eastern Himalayas and the mountains between Assam and Burma. These are areas of high rainfall and high humidity. In the western Himalayas where the rainfall is not so generous, it is rare to find the species growing luxuriantly. A specimen in the Herbarium at Kew, from Haldwani, U.P., has, however, a panicle about 40 cm. long.

Were it not for the well developed awn of the Assam species, they could easily be confused with *A. decempedalis* of the plains of Assam and Goalpara.

This species is not common in Bombay and in the drier parts of India.

16. **Arundinella purpurea** *Hochst. ex Steud.*, Syn. Pl. Glum. 115 (1854).

A. fuscata Hook. f., Flor. Brit. Ind. **7,** 74 (1896) non Nees ex Buese.

A perennial grass. *Culms* up to 85 cm. tall, terete, striate, scabrid and pilose below the panicle and nodes with hairs from tubercle-bases, or rarely glabrescent and smooth, simple, hairy at the nodes. *Leaf-blades* drying a yellowish-green, rounded at the base or suddenly contracted to the sheath, lanceolate, oblong or linear, eventually tapering to a stoutish tip or gradually contracting from base to tip, which is usually scabrid, densely covered on the upper surface with a thick coat of tubercle-based hairs, less hairy on the lower surface to almost glabrous, glabrescent with age, up to 20 cm. long by 1 cm. wide, scabrid and often ciliate on the margins, in low specimens crowded at the base ; *sheaths* tight, clasping, striate, pilose to densely hirsute with tubercle-based hairs ; *ligule* obscure, at most a very narrow membrane.

Inflorescence a very dense, rarely a lax panicle consisting of an erect sulcate angled densely hispid axis with the hispid scabrid spikelet-bearing branches arranged alternately upon it ; branches ascending, straight, parallel, carrying crowded spikelets. *Spikelets* 3·5–4·5 (5·5) mm. long, usually longer than their pedicels. *Lower glume* 2·5–3 mm. long, almost orbicular-acute, 3-nerved compressed at the apex, scabrid on the nerves, otherwise smooth and glabrous ; *upper glume* 3·5–4 mm. long, broadly elliptic-acuminate, 5-nerved, compressed and keeled in the upper third, scabrid on the nerves, otherwise smooth and glabrous. *Lower floret* ♂ or

neuter ; *lemma* 3–3·5 mm. long, rounded on the back, membranous, smooth and glabrous, 3-nerved, somewhat compressed at the tip ; *palea* elliptic-acute, rather shorter than the lemma, 2-keeled, smooth on the keels, hyaline, elliptic-acute in shape ; *stamens* 3 ; *anthers* 0·75 mm. long. *Upper floret* ♀ ; *lemma* 1·5 mm. long, milky-white, rather chartaceous, papillose-scabrid at the tip, awned in a notch, naked on the rounded *callus* ; *palea* oblong obtuse, 2-keeled, of same texture as the lemma, papillose hairy in the upper half ; *styles* 2 ; *stigmas* plumose ; *stamens* 3 ; *anthers* 1·25 mm. long ; *awn* geniculate, 3 mm. long ; *column* chestnut-brown, twisted, 1 mm. long.

var. **purpurea.**

Ind. Or. : Madras ; Nilagiri 1818–1835, *B. Schmid* ; Herb. Wight. ; Nilagiri, 1851, *Hohenacker* 928 (Type of *A. purpurea* Hochst. in Herb. Kew.) ; Nilgiri Hills, Ochterloney Valley, 18 Aug. 1878, *G. King* ; Nilgiris, Conoor Peak, Aug. 1883, 1040 m., *J. S. Gamble* 12287 ; ibidem, Oct. 1884, 1950 m., *J. S. Gamble* 15401 ; ibidem, Naduvatam, 1500 m., Oct. 1886, *J. S. Gamble* 18299 ; Nylgherries, *Sir G. Adam* ; Naduvatam, 1800 m., 1888, *M. A. Lawson*—open pastures ; very common on the western side of the Nilgiris ; Mysore, Bababudan Hills, 20 Oct. 1890 ; Pulneys, river bed, Silver Cascade, 26 May, 1898, *A. G. Bourne* ; Kodaikanal Falls, 5 Jul. 1898, *Bourne* ; Pykara, June 1900, *Bourne* ; Pulneys, 1901, *Bourne* ; Downs, Ootacamund, 25 Sept. 1908, *Bourne* 5241 ; Gersoppa Falls, 600 m., Oct. 1908, *Meebold* 10461 ; Mysore, Kunsi, Oct. 1908, 6–900 m., *Meebold* 10762 ; Downs, Ooty, 30 Aug. 1900, Bourne 5349; near Naduvattam, Sept. 1934 *Barnes* 875 ; Herb. *Wight* 1667 (Type of *A. fuscata* Nees in Herb. Kew.).

var. **laxa** *Bor*, var. nov. a typo panicula laxa, spiculis longi-pedicellatis differt.

Madras ; Sispara, 2100 m., Nov. 1883, *J. S. Gamble* 13365 ; ibidem 2100 m. May 1889, *J. S. Gamble* 20617.

In the Flora of British India this species appears under the name of *A. fuscata* Nees ex Buese. The leaves of this species dry a greenish-yellow, which is quite different from the colour of dry leaves of any of the other species in the area under consideration. Moreover, they and the sheaths are thickly covered with tubercle-based hairs. The panicle is usually dense and the spikelets purplish, but a well-marked variety with a lax panicle is found at Sispara in the Nilgiris. Apparently this is a good variety for Gamble collected it at Sispara on two occasions separated by an interval of six years. One of the latter specimens exhibits proliferation of the spikelets, the only instance in the genus known to the writer.

When, through the courtesy of Prof. H. J. Lam, the type of *A. fuscata* Nees ex Buese was obtained from Leiden, it was discovered that the Indian species could not be referred to *A. fuscata* Nees. *A. fuscata* Nees is an annual, the leaves do not dry the peculiar greenish-yellow colour of the Indian specimens and the spikelets are very pale. The hispid angled rhachis of the Indian plant is a complete contrast to the smooth and glabrous rhachis of the Javanese *A. fuscata*. Fortunately there is no need for a new name since the type of the Indian plant is Hohenacher's no. 928 from the Nilgiris which was called *Arundinella purpurea* by Hochstetter and the description was published by Steudel. See page 414.

17. **Arundinella intricata** *Hughes* in Kew Bull. **1920,** 112 (1920).

A perennial grass with many tough rhizomes. *Culms* densely caespitose, erect or somewhat geniculate, very tough, branching, smooth and

glabrous, even at the nodes. *Leaf-blades* linear-acuminate, up to 20 cm. long, 5 mm. wide, very firm, flat eventually involute, furrowed on the upper surface with a thick midrib ending in a very stout scabrid tip, often densely ciliate on the margins with short hairs on the upper surface just above the ligule, smooth and somewhat scabrid below ; *sheaths* firm, tough, smooth and glabrous, except one margin which is densely ciliate ; *ligule* a narrow membrane which is long and densely ciliate.

Inflorescence a panicle up to 13 cm. long, 1·5–2 cm. wide, consisting of a straight or flexuous axis irregularly branched or the branches subwhorled ; axis angled, sulcate, densely and finely ciliate along the angles. *Spikelets* pedicelled, gaping 4–4·5 mm. long ; pedicels shorter than the spikelets, hairy, slightly expanded at the tips. *Lower glume* elliptic-acute, compressed at the tip, 3 mm. long, 3–5-nerved, glabrous, purplish, smooth on the nerves ; *upper glume* broadly elliptic-acuminate, as long as the spikelet, 5-nerved, scabrid on the nerves, otherwise smooth and glabrous. *Lower floret* ♂ ; *lemma* rather thinner than the upper glume, suffused with purple, elliptic-acute, 5-nerved, the outer two being close together, slightly keeled towards the tip ; *palea* smaller, lanceolate-acute, 2-keeled, ciliate on the flaps above and toothed below ; *stamens* 3 ; *anthers* 1 mm.. long. *Upper floret* ♀ ; lemma 2–3 mm. long, with an obtuse hairy callus, elliptic in shape, milky, minutely scabrid, 3-nerved, very minutely lobed at the apex ; *palea* of same texture, 2-nerved, shorter and narrower ; *awn* 5–6 mm. long ; *column* chestnut, twisted ; *styles* 2 ; *stigmas* plumose ; *stamens* 3 ; *anthers* 1 mm. long.

Ind. Or. : Khasi Hills, Mawflong wood, 1200–1800 m., 26 Oct. 1850. *Hook. f. et T. Thoms.* ; Amwee, 1200–1500 m., 1850, *Hook. f. et T. Thoms.* ; Mausmai, 1200 m., 23 Oct. 1871, *C. B. Clarke* 16588 ; Mahadeo, 900 m., 22 Oct. 1871, *C. B. Clarke* 15622 ; Pangtum Forest, Dawki Road, 28 Aug. 1935, *Shri Ram Sarma* 12327 (sheet in Dehra Dun Herb.).

Hughes also quotes a sheet (in Herb. Cal.) collected by Burkill on the banks of the Dihang river in northeast Assam, near Ritung (Burkill 373), on which the collector made the following remarks. "A grass which makes tussocks and in places quite clothes the bank above the river. It mats its tussocks together with its roots which come out of the top of the soil as well as run all through it." The species is obviously of supreme value as a soil binder.

18. **Arundinella metzii** *Hochst. ex Miq.* in Verhand. Nederl. Inst. **3,** pt. 4, 31 (1851).

A. lawii Hook. f. in Trim., Handb. Flor. Ceyl. **5,** 180 (1900).

A. decomposita Janowsky in Fedde, Rep. Sp. Nov. **17,** 84 (1921).

A. pygmaea Hook. f., Flor. Brit. Ind. **7,** 72 (1896).

An annual grass. *Culms* slender, terete, striate, very minutely scabrid or smooth, glabrous or sparsely hairy below the panicle with soft white hairs from tubercle-bases, glabrous at the nodes or with an appressed silky pubescence, simple, erect or somewhat geniculate below. *Leaf-blades* linear from a somewhat rounded base, tapering to an acuminate scabrid tip, up to 40 cm. long, 9 mm. wide, but usually much shorter and narrower, in depauperate specimens a few centimetres long and millimetres broad, pilose on both surfaces with a very variable amount of indumentum consisting of tubercle-based hairs, slightly scabrid on the

margins ; *sheaths* tightly clasping, very striate, usually hispid with spreading tubercle-based hairs, densely ciliate on one margin ; *ligule* a narrow membrane, 0·5–1 mm. broad, uneven or lacerate on the upper edge.

Inflorescence an erect panicle up to 50 cm. long, 25 cm. wide, usually much shorter and narrower, consisting of a straight erect central axis, angled and sulcate, scabrid on the angles, bearing ascending slender branches up to 15 cm. long ; branches simple, slender, carrying the spikelets in pairs, one short- one long-pedicelled. *Spikelets* 3–4·5 mm. long, gaping, pale or suffused with purple, quite glabrous or slightly to very bristly with tubercle-based hairs. *Lower glume* 2–2·5 mm. long, lanceolate or elliptic-acute when flattened, 3-nerved, scabrid on the nerves which are strongly marked, otherwise smooth and glabrous, or covered with a variable amount of tubercle-based hairs between the nerves and on the margins ; *upper glume* 2·75–4·25 mm. long, elliptic-acuminate when flattened, upper quarter very narrow and folded to take the awn of the upper lemma, smooth and glabrous or hairy like the lower glume. *Lower floret* ♂ ; *lemma* 1·75–2·5 mm. long, oblong-acute, hyaline, 3-nerved ; *palea* smaller, hyaline 2-nerved ; *stamens* 3 ; *anthers* 0·6–1 mm. *Upper floret* ♀ ; *lemma* 1 mm. long, elliptic-oblong in shape, notched at the apex, flat on the dorsal surface, smooth and glabrous except somewhat scabrid towards the tip, awned, bearded on the callus ; *palea* same texture, 2-keeled ; *styles* 2 ; *stigmas* plumose ; *stamens* 3 ; *anthers* 0·9–1 mm. long, *awn* 3 mm. long ; *column* chestnut-brown 1–3 mm. long.

Ind. Or. : Madras ; Canara, near Mangalore, *Hohenacker* 297 (Typus in Herb. Kew.) ; Wynaad, Dec. 1876 *Rottler* ; Canara, Dec. 1871, *Thomson*, Eclipse Expedition; Malabar, Taliparamba, March 1907, *Bourne* ? ; Herb. Heyne, *Wall.* 8668 ; Talguppa, Mysore, 600 m., Oct. 1908, *Meebold* 10596 ; Upin Ongadi, Nov. 1908, *Meebold* 10497.A ; Mangalore, Nov. 1908, *Meebold* 10760 ; Saga, Mysore, 600–900 m., Oct. 1908, *Meebold* 10759 ; Suadi, S. Kanara, Nov. 1908, *Meebold* 10761 ; Coimbatore, 3 May 1940, I.F.C. student ; Tellicherry, in Urti evergreen forests, 3 May 1940, I.F.C. student ; Deccan, *Woodrow* (considered by Hook. f. to be identical with type of *A. lawii*).

Bombay ; N. Kanara 540 m., 15 Jan. 1890, W. A. Talbot 2249 ; Poona Dist., 15 Dec. 1906, *W. A. Talbot* 5047 ; Mungod Range, 3.5.1940, *I. F. College Student* ; North and South Concan, *Law* ; Purandhar, 1911, *Blatter* ; Belgaum, 15 Jan. 1915, *R. S. Hole* 9 ; Sion, Bombay Isl., Nov. 1916, *Blatter*, 5232 ; Campuli, foot of Ghats, March 1917, *Blatter* 5343 ; Igatpuri, Oct. 1917, *Blatter* 4329, 4332 ; Khandala, *Blatter* ; Purhandhar, 1200 m., Dec. 1917, *Blatter* ; Igatpuri, 600 m., Feb. 1918, *Sedgwick* 3542 ; Khandala, Tata's Lake, Oct. 1918, *Blatter* ; Yellapur, in teak, 3 May, 1940 *I.F.C. Student* ; North Canara, *Lisboa* (type of *A. pygmaea*).

As with most species of *Arundinella* the search for stable characters within this species, whereby some of the forms could be separated as good varieties, has been in vain. At one time the hairy nodes and spikelets of *A. lawii* offered some hope of valid grounds for preserving Hooker's specific epithet as a varietal name. This has proved to be impossible, as intermediates and specimens with hairy spikelets and glabrous nodes or glabrous spikelets and hairy nodes, as well as every possible degree of hairiness are to be found.

19. **Arundinella vaginata** *Bor* in Journ. Ind. Bot. Soc. **27,** 66 (1948).

A. villosa Arn. ex Steud. var. *Heynei* Hook. f., Flor. Brit. Ind. **7,** 73 (1896).

A perennial grass with a very stout woody rootstock, covered at the base with numerous leaf-sheaths. *Culms* erect, up to 70 cm. tall, densely villous below the panicle, villous on the upper parts of the internodes and glabrescent towards their base, villous on the nodes, terete, with extremely short internodes at the base. *Leaf-blades* up to 40 cm. long, 7 mm. wide, linear, long-attentuate, involute or rolled, very villous on the lower surface with tubercle-based hairs, less so on the upper surface or glabrescent, scaberulous on both surfaces, ending in a blunt scaberulous tip ; *sheaths* very much longer than the internodes, especially the lower ones, very loose and slipping from the culms, usually very villous from tubercle-based hairs, but the older sheaths glabrescent, striate, smooth ; *ligule* a very narrow membranous ring.

Inflorescence a narrow erect interrupted panicle consisting of a central axis upon which are arranged ascending racemes of congested spikelets ; axis about 15 cm. long, angled, very villous with usually the lowest raceme much separated from the others ; racemes about 3 cm. long with spikelets seated in pairs on a very villous rhachis. *Spikelets* mostly in pairs, one short-pedicelled, one longer-pedicelled, 6·5–7 mm. long. *Lower glumes* 6–6·5 mm. long, elliptic in shape, aristulate, 5–3-nerved, the lateral close, bristly with tubercle-based hairs on all five nerves ; *upper glume* 6·5–7 mm. long, elliptic-acute with tip compressed into a beak 2 mm. long, 5-nerved with occasionally an extra faint nerve outside the others, bristly on the dorsal nerves as in the lower glume. *Lower floret* ♂ ; *lemma* 6 mm. long, elliptic-acute when flattened, compressed at the apex, 5-nerved with the two lateral close together, smooth and glabrous, scabrid on the keel and at the apex ; *palea* lanceolate-acute, 2-keeled, 4·5 mm. long ; *stamens* 3 ; *anthers* 1·75 mm. long. *Upper floret* ♀ ; *lemma* bearded on the callus, 3·5 mm. long, elliptic-oblong-acute, 2-lobed and awned at the apex, faintly 5-nerved, scaberulous on the dorsal surface ; *palea* as long, 2-keeled ; *stamens* 3 ; *anthers* 1·5–2·25 mm. long ; *awn* 5·5 mm. long ; *column* twisted, 3 mm. long.

Ind. Or. : Madras ; Herb. Heyne. *Wall* 8663A (type of *A. villosa* Arn. ex Steud. var. *Heynei* Hook. f.) ; Pulney Hills, 1914, Rev. Saulière 817 ; Kodaikanal Pulney Hills, 2100 m., Feb. 1922, *L. Anglade* 2202 ; Kodaikanal Ghat, 18 May 1898, *Bourne* ; Attapadi Hills, south Malabar, 14 Oct. 1910, *Fischer* 2290 ; Kulhutty Babab, 1800 m., Oct. 1908, *Meebold* 10455.

The numerous basal long villous sheaths, villous spikelets and very villous peduncle distinguish the species. It was erroneously stated in the article in the Journ. Ind. Bot. Soc. that the type was Saulière's no. 817. This is not so, for Hooker based this variety on Wallich's 8663A.

20. **Arundinella hookeri** *Munro ex Keng* in Rep. Nat. Centr. Univ. Sci. sér. B. Biol. **2,** no. 3, 50 (1936).

A. villosa Arn. ex Steud. var. *himalaica* Hook. f., Flor. Brit. Ind. **7,** 73 (1896).

A perennial grass, completely bare at the base or with a few white hairs in the grooves of the basal sheaths. *Culms* up to 45 cm. tall, erect or only slightly decumbent at the base, terete, smooth and glabrous, usually long-exserted from the topmost leaf-sheath, glabrous on the nodes. *Leaf-blades* up to 12 cm. long, usually much less, 6 mm. wide, usually flat, lanceolate-attenuate in shape from a slightly rounded base, many-nerved

covered on both surfaces with soft white hairs from tubercle-bases, very minutely scabrid on both surfaces and on the margins ; *leaf-sheaths* slipping from the culms, markedly striate, villous with soft white hairs from tubercle-bases situated in the grooves, glabrescent in the lower half or even quite glabrous ; ligule a very narrow membranous ring.

Inflorescence an interrupted panicle of short racemes up to 15 cm. long; axis terete below, angled above, glabrous, becoming more and more villous towards the tip ; racemes alternate on the axis, 1·5–2 cm. long consisting of an angled scabrid rhachis, spiculate to the base and covered with long soft colourless bristles. *Spikelets* 5–6 mm. long, usually paired on short and long pedicels. *Lower glume* 4–4·5 mm. long, elliptic-acuminate when flattened, 3–5-nerved, bristly on the nerves on the dorsal surface with tubercle-based hairs, otherwise smooth and glabrous ; *upper glume* 5–6 mm. long, elliptic-acuminate in shape when flattened, 5-nerved, the two lateral, but not the median nerves, with tubercle-based bristles. *Lower floret* ♂ ; *lemma* 4 mm. long, 5-nerved, the two lateral close together, oblong-acute in shape, compressed at the apex, rounded on the back, smooth and glabrous, scabrid on the keel above ; *palea* 3·5 mm. long, 2-keeled ; *stamens* 3 ; *anthers* 1·25 mm. long. *Upper floret* ♀ ; *lemma* long-bearded on each side of the callus, 2·25–2·5 mm. long, membranous, oblong, rounded and slightly 2-lobed at the apex, faintly 5-nerved, awned, minutely scaberulous in the upper half ; *palea* oblong-acute, slightly longer than the lemma, 2-keeled ; *awn* 3–4 mm. long ; *column* twisted, chestnut, 1·5 mm. long ; *stamens* 3 ; *anthers* 1·5 mm. long ; *styles* 2 ; stigmas plumose.

Ind. Or. : Bhutan, *Griffith* 6788 (type of *A. villosa* var. *himalaica*) ; Sikkim, Lachung meadows, 3000 m., 31 Jul. 1849 *Hook. f.* ; Mintokong, south-east of Yoksum, June 1888, Dr. King's collector ; Burkeem, 2,250 m., 12 Oct. 1875, *C. B. Clarke*.

Tibet ; Yatung, 1897, *H. E. Hobson*.

This striking species seems to be confined to Sikkim, Bhutan and Tibet, and is only found at high altitudes.

21. **Arundinella ciliata** (*Roxb.*) *Nees ex Miq.* in Verhand. Nederl. Inst. **3,** pt. 4, 30 (1851).

Holcus ciliatus Roxb., Flor. Ind. **1,** 321 (1820).

Arundinella pilosa Hochst. ex Miq. in Verh. Nederl. Inst. **3,** pt. 4, 30 (1851).

A. agrostoides Hook. f., Flor. Brit. Ind. **7,** 71 (1896) non Trin.

A. hirsuta Nees non Hochst. ex Steud., Syn. Pl. Glum. 115 (1854).

An annual grass. *Culms* slender or stout, erect from a narrow or much thickened base, up to 60 cm. tall, often completely covered by the sheaths, erect, simple, very smooth and glabrous or sparsely pilose, particularly below the panicle with spaced hairs from tubercle-bases, pilose at the nodes. *Leaf-blade* rounded, almost cordate at the base, flat, flaccid, covered on both surfaces with a thick covering of tubercle-based hairs, or almost glabrescent below, lanceolate- or oblong-acute, up to 15 cm. long, 14 mm. wide ; *sheaths* often overlapping, tight, clasping, very striate, more or less thickly covered with spreading tubercle-based hairs, densely ciliate on one margin ; *ligule* a narrow membrane 1 mm. broad, lacerate and sometimes ciliate on the upper edge.

Panicle erect, consisting of an angled sulcate axis which is scabrid on the angles and occasionally pilose with tubercle based hairs, upon which are arranged alternately or subwhorled, branches up to 3 (5) cm. long, which may rebranch and carry densely or loosely arranged spikelets seated on pedicels which are usually shorter than the spikelets, the whole forming a very dense or rarely loose cylindrical or narrowly ellipsoidal panicle. *Spikelets* up to 3·5 mm. long, often very bristly, with the lower glume much exceeding the lower lemma in length. *Lower glume* 2·5–3·5 mm. long, elliptic acute with tip produced into a short seta, 3-nerved, the nerves anastomosing at the tip, often covered on the dorsal surface with dense tubercle-based hairs ; *upper glume* about as long as the lower glume or 0·5 mm. longer, 5-nerved, elliptic-acuminate, the upper third being very narrow, plicate and holding the awn in the young state, often very bristly on the dorsal surface with tubercle-based hairs. *Lower floret* ♂ ; *lemma* 1·25–2·5 mm. long, membranous to hyaline, elliptic-oblong-acute, 3-nerved, glabrous and smooth, awned ; *palea* elliptic-obtuse, shorter and narrower than the lemma ; *stamens* 2 or 3 ; *anthers* minute, 0·25 mm. long. *Upper floret* ♀ ; *lemma* 1–1·5 mm. long, whitish smooth below, papillose, scabrid above ; palea of same texture and colour, elliptic, 2-keeled ; *stigmas* plumose ; *stamens* 3 ; *anthers* 0·5 mm. long ; *awn* 5–7 mm. long ; *column* chestnut-brown 2·5–3 mm. long.

Ind. Or. : Madras ; Herb. *Wight* 1666 (Type of *A. ciliata* Nees) ; Herb. *Wallich* 8664 and 8671 ; Nilgiris, Naduvatam, 1800 m., Oct. 1884, *Gamble* 14886 (type of *A. agrostoides* Hk. f. non Trin. var. *ciliata* Hook. f. in Herb. Kew.) ; Annamalais, Poonachi, Oct. 1901, *C. A. Barber* 3751 ; Travancore, Kutatupuzha, Nov. 1901, *Bourne* ; Coimbatore, Baiher, 1200 m., 23 Nov. 1905, *Fischer* 744 ; ibidem, Bellagi, 1500 m., 17 Nov. 1906, *Fischer* 1359 ; Mysore, Aglatti, 1050 m., Nov. 1908, *Meebold* 10570 ; Vellimalai-Annamalai Hills, 1050 m., 25 Oct. 1913. *Fischer* 3651.

The type specimen of *Holcus ciliatus* Roxb. is not extant, but there is an excellent drawing of the grass in the Icones Roxburghianae. Nees' *A. ciliata* matches the drawing in all essentials. This species, which is quite unmistakable, is endemic in Madras State.

22. **Arundinella birmanica** *Hook. f.*, Flor. Brit. Ind. **7,** 73 (1896).

An annual grass. *Culms* up to 35 cm. tall, terete, striate, rather stout, softly and sparsely pilose below the panicle, profusely bearded at the nodes, simple, erect or somewhat decumbent at the base. *Leaf-blades* rounded or somewhat cordate at the base, linear, tapering to an acuminate scabrid tip, up to 27 cm. long, 14 mm. wide, soft, flaccid, softly hirsute on both surfaces with tubercle-based hairs, but the amount of indumentum is extremely variable and many leaves are glabrescent, ciliate along the margins with similar hairs, upper leaves lanceolate ; *sheaths* tight clasping, striate, covered with tubercle-based hairs, the lower sheaths slipping from the culms ; *ligule* a narrow membrane less than 1 mm. broad, uneven on the upper margin.

Inflorescence a panicle, at times moderately dense, consisting of an erect central axis which is sulcate, angled, scabrid on the angles and very sparsely adorned with soft tubercle-based hairs, upon which are to be found ascending branches not more than 4 cm. long, which are alternate, subfascicled or subverticillate ; branches angled, scabrid, carrying spikelets, in pairs or singly, on short scabrid pedicels of unequal length.

Spikelets 4·5–5·5 mm. long, gaping widely, bristly. *Lower glume* (2·75) 3–3·75 mm. long, elliptic-acuminate, shortly aristulate at the tip, 3- rarely 5-nerved, the nerves anastomosing near the tip, hairy all over the dorsal surface with soft hairs from small tubercle-bases ; *upper* glume 4·5–4·75 mm. long, elliptic-acuminate in shape with the upper third very narrow and nearly always recurved, somewhat plicate, the awn when young lying in the fold, 5-nerved ; the nerves anastomosing near the tip, scabrid on the midnerves. *Lower floret* ♂ or neuter ; *lemma* 3 mm. long, broad-elliptic-obtuse when flattened, smooth and glabrous, membranous, 3-nerved, rounded on the back below, keeled for a short distance above ; *palea* 2 mm. long, 2-nerved, hyaline, delicate ; *stamens* 3 ; *anthers* 0·75–1 mm. long. *Upper floret* ♀ ; *lemma* with a hairy callus, elliptic-oblong-obtuse, turning brown at maturity, smooth in the lowest three-quarters becoming scabrid-papillose in the upper quarter, awned ; *palea* of the same texture and colour, 2-nerved, covered all over the adaxial surface with papillose asperities ; *styles* 2 ; *stigmas* plumose ; *stamens* 3 ; *anthers* 1 mm. long ; *awn* 6 mm. long ; *column* 2·5 mm. long, chestnut-brown, twisted.

BURMA ; Moulmeyn, *Griffith* ; Rangoon, *Kurz* 3161 (Typus in Herb. Kew) ; Pazwoandoung, *Kurz* 1132 ; Rangoon 1854, *McClelland* ; Insein, Mingladon 9 m., 14 Nov. 1950, *Po Khant* 1809—Grass about 2 ft. high with white flowers, growing in open places.

This species is close to *A. holcoides* but it is a more robust grass, the spikelets are larger and the panicle stiffer and more dense. It may be that future collections will show a series of intermediates which would justify sinking *A. birmanica* in *A. holcoides*, but such a series is not yet at hand for examination. I have therefore decided that it is better to keep the two species apart for the present.

23. **Arundinella holcoides** (*Kunth*) *Trin.* in Bull. Acad. Sci. Petersb. **1,** 71 (1836).

A. agrostoides Trin., Sp. Gram. Ic. **3,** (1836) t. 265.

Brandtia holcoides Kunth, Révis. Gram. **2,** 511 (1830) t. 120.

An annual grass. *Culms* up to 45 cm. tall, terete, usually shortly decumbent at the base, smooth and glabrous or sparsely pilose below the panicle, hirsute at the nodes. *Leaf-blades* rounded at the base to the sheath, lanceolate-acute or linear-acuminate up to 15 cm. long by 1 cm. wide, usually much shorter and narrower, covered on both surfaces with tubercle-based hairs, often more or less congregated at the base, flaccid, ending in a stout scabrid tip ; *sheaths* of two kinds, those at the base very loose, slipping from the culm, very short, pilose from tubercle-based hairs, glabrescent, smooth, those higher up tight, clasping, striate, villous with numerous tubercle-based hairs situated between the nerves ; *ligule* a very narrow membrane.

Inflorescence up to 15 cm. long, 2 cm. broad, a narrow panicle consisting of an axis, at each node of which arise 1–several branches ; axis terete below, angled above, more or less pilose with tubercle-based hairs and scabrid on the angles ; branches at each node 1–5 or –6, short or up to 3 cm. long, branching and rebranching, scabrid, sparsely pilose but very pilose at the junction with the axis. *Spikelets* 3–3·5 mm. long, solitary or paired, one short, the other longer-pedicelled. *Lower glume*

2–2·5 mm. long, elliptic-aristulate when flattened, strongly 3-nerved, somewhat bristly from tubercle-based hairs on the nerves and sometimes on the interspaces ; *upper glume* 3–3·5 mm. long, elliptic-acuminate in shape, the upper half narrowed and compressed into a beak which holds the awn of the upper lemma, 5-nerved, more or less bristly on the back with tubercle-based hairs. The tip of the lower glume reaches the tip of the lower lemma and just exceeds it. *Lower floret* ♂ or neuter ; lemma 1·5–2 mm. long, oblong-acute in shape when flattened, chartaceous, very smooth and glabrous, 3-nerved ; *palea* as long as the *lemma*, 2-keeled ; *stamens* 3 ; *anthers* 0·25 mm. long. *Upper floret* ♀ ; *lemma* chartaceous becoming firmer, with an obtuse callus bearded on the sides, 1 mm. long, elliptic or oblong in outline, scabrid on the dorsal surface in the upper half ; *palea* as long and of the same texture, 2-keeled ; *stamens* 3 ; *anthers* 0·4 mm. long ; styles 2 ; *stigmas* plumose.

Ind. Or. : Burma ; Tenasserim, *Helfer* ; Hb. Mergui, *Griffith* 334, 698; *Griffith* 6790.

Enquiries at Paris and Berlin have failed to locate the type sheet of *Brandtia holcoides* Kunth, but the excellent figure of the plant in Kunth's Révision des Graminées leaves little room for doubt about the characteristics of the plant. The type of *Arundinella agrostoides* Trin. is at Kew and it agrees well with Griffiths' specimens cited above. This plant has been much confused with *A. ciliata* (Roxb.) Nees, but the two are very different as pointed out on p. 384.

Note added in page-proof.

The greenish yellow colour of the leaves of *A. purpurea* Hochst. suggested that it might be an aluminium-accumulator. Dr. Chenery, of the Kawanda Research Station, Uganda, confirms that this is so, and that *A. fuscata* is without any reaction whatever. Incidentally, this is the first occasion in which such a reaction has been found in a species of the *Gramineae*.

Bibliography on Southwestern Asia.*.—Universities and libraries everywhere will welcome this second compilation of the Anthropogeographical Bibliography of selected titles to cover the areas Istanbul to the Hindu Kush on the north, Aden to the Makran coast on the south, and the Suez Canal on the west to the eastern boundary of Afghanistan.

The countries dealt with are Turkey (Anatolia), Syria, Lebanon, Israel, Egypt (Sinai), Jordan, Saudi Arabia, Yemen, Aden (Colony, Western and Eastern Protectorates and Socotra and Abd-el-Kuri islands), Dhufar, Oman (including Trucial Oman Coast), Qatar Peninsula, Bahrain Island, Neutral Zones (2), Al Kuwait, Irak, Iran, Caucasus (mainly Transcaucasia), Afghanistan and West Pakistan (formerly Baluchistan).

As in the previous part this useful bibliography contains a list of abbreviations and is divided into (1) Anthropogeography and (2) Natural History, followed by the author index.

H. S. Marshall.

* Bibliography on Southwestern Asia : II. A Second Compilation. By Henry Field. Pp. xviii + 126. University of Miami Press. 1955. (No price stated).

NOTES ON CYPERACEAE, XXXVIII.*

E. Nelmes

Scleria Berg, Sect. Hypoporum (Nees) Endl. in Africa.

The genus *Scleria* in Tropical Africa has had no serious and comprehensive study since C. B. Clarke produced a descriptive account of the genus for the Flora of Tropical Africa over half a century ago. The following revision of a section of the genus in Africa has been prepared in connection with the description of the *Cyperaceae* for the Flora of Tropical East Africa.

Apart from H. Chermezon's Revision of Madagascar *Scleria* (Arch. Bot. 7, Mém. 2 : 88–101 : 1936), there has been only one other publication of note on African *Scleria*. This is by P. Piérart, " Les Espèces du Genre *Scleria* Berg, du Congo belge et du Ruanda-Urundi ", and it was published in 1953 as Mémoire 13 of the periodical Lejeunia. This fine piece of work, dealing with 36 species, runs to 68 pages of text and 5 plates of numerous figures mostly of achenes.

It is the intention to follow this present revision of Sect. *Hypoporum* with an account of the other sections of the genus. That will be the appropriate occasion to give a full generic and also sectional descriptions. Meanwhile here follow a few preliminary remarks on *Scleria* and Sect. *Hypoporum*.

The genus *Scleria* is the largest of the tribe *Sclerieae*, which belongs to that part of the family *Cyperaceae* with unisexual flowers which are here borne in unisexual and sometimes bisexual spikelets. These are in panicles or in contracted, glomerate-spicate inflorescences. The fruits have a hard surface, are obtusely or obscurely trigonous, and are often white and shining, but sometimes the surface is variously sculptured. At the base of the achene, except in Sect. *Hypoporum*, is a structure known as the hypogynium, which is often dilated into a triangular, trilobed, or cup-like disc.

Sect. *Hypoporum* may be considered primitive in having androgynæceous spikelets which are replaced by or reduced to female spikelets in the remainder of the genus (male spikelets are present in all the several sections). On the other hand, the members of Sect. *Hypoporum* are much reduced, compared with the other species of the genus, having slender smooth stems, narrow leaves, glumiform bracteoles and a glomerate-spicate inflorescence. There is also a much larger proportion of annuals in this section, which may be considered a further indication of its advanced character.

Another character by which Sect. *Hypoporum* is distinguished is the absence or obsolescence of the hypogynium. This absence of the hypogynium in *Hypoporum* has been suggested as being an indication of primitive condition, but the writer feels inclined to the opposite opinion, that the hypogynium has tended to become reduced and vestigiate.

A remarkable fact has emerged from the study of this group. It is the inconstant nature of the achene. This occasionally ranges from smooth to tuberculate and sometimes to lacunose or other surface markings on the

* Continued from K.B. 1955 : 319 (1955).

same gathering and even on the same plant. This inconstancy of the fruit, usually the principal distinguishing character in the *Cyperaceae*, apart from being a most surprising thing, makes much more difficult the separation of the species and the construction of a key. Variation in fruits in *Scleria* is mentioned by Core in his revision of the American species (Brittonia, 2 : 1-105 ; 3 plates of 39 figs. : 1936). On p. 25, under *S. leptostachya* Kunth, he remarks that the type collection of that species consists of plants with smooth and plants with extremely verrucose achenes. He adds : " Such a variation in the achenes is somewhat unusual for *Scleria* and it might be thought that the collection was mixed, were it not for the fact that both kinds of achenes may in some cases be found on the same individual ".

The following characters are common to all, or nearly all, the members of *Scleria*, Sect. *Hypoporum*. They are given here to save repeating them throughout the Section.

Stems distinctly trigonous, more or less erect. *Leaves* linear or narrowly linear, occupying and sheathing the lower half to much of the stem, usually shorter than the stem, basal ones reduced to almost bladeless sheaths ; *sheaths* with a ligular zone not or poorly developed. *Inflorescence* glomerate-spicate (except in *S. prophyllata* Nelmes), terminal (also lateral in *S. lithosperma* (L.) Swartz.). Leafy *bracts* 0—except with the axillary partial panicles of *S. lithosperma*—related to the fact that the inflorescence is terminal in the other 32 species. *Achene* includes a trigonous stipe or gynophore. *Stigmas* 3.

The abbreviations used to indicate location of the cited specimens are the same as those given in Index Herbariorum, part I, by J. Lanjouw and F. A. Stafleu, ed. 2, 1954.

Artificial Key to the African Species of *Scleria*, Sect. *Hypoporum*

A. Perennials with a more or less elongated rhizome.

1. Inflorescence partly lateral, in the axils of leafy bracts
1. *S. lithosperma*

1. Inflorescence wholly terminal, without leafy bracts :

2. Leaves 10–15 mm. wide ; tongue of leaf-sheath 5–10 mm. long ; achene 3–3·5 mm. long . . . . . 2. *S. lacustris*

2. Leaves 0·75–10 mm. wide ; tongue of leaf-sheath 0–4 mm. long ; achene 0·9–2 mm. long :

3. Stems bulbous at the base :

4. Leaves 5–10 mm. wide ; inflorescence very compound with branches up to 4 cm. long ; awn of the female glumes 3–3·5 mm. long ; achene smooth . . . 18. *S. verdickii*

4. Leaves 1–5(9) mm. wide ; inflorescence usually unbranched but sometimes 1-several lower glomerules partly on short peduncles ; awn of the female glumes 1–3 mm. long ; achene smooth, tubercled, trabeculate, or lacunose
19. *S. bulbifera*

3. Stems not bulbous :

5. Rhizome bearing small tubers (inflorescence unbranched, 2–8 cm. long ; spikelets 4–5 mm. long ; achene trabeculate-verrucose) . . . . . 20. *S. dieterlenii*

5. Rhizome not tuberous :

6. Glomerules reflexed (inflorescence unbranched, 3·5–18 cm. long ; spikelets 4–5 mm. long) :

7. Mouth of leaf-sheath truncate or slightly convex ; achene smooth . . 31. *S. hirtella* var. *hirtella*

7. Mouth of leaf-sheath produced into a tongue up to 4 mm. long ; achene tuberculate to trabeculate 31. *S. hirtella* var. *chondrocarpa*

6. Glomerules not reflexed :

8. Mouth of leaf-sheath produced into a tongue :

9. Inflorescence unbranched ; female glumes villous, awns 2–4 mm. long . 17. *S. erythrorrhiza*

9. Inflorescence branched ; female glumes glabrous or nearly so, awns 0–1 mm. long :

10. Spikelets 5–7 mm. long ; glumes fulvous to castaneous ; achene ellipsoid or ovoid 3. *S. welwitschii*

10. Spikelets 4–5 mm. long ; glumes reddish-brown to blackish-red ; achene ovoid-globose or depressed-globose 4. *S. rehmannii*

8. Mouth of leaf-sheath truncate or concave :

11. Inflorescence copiously once to thrice branched :

12. Inflorescence thrice branched ; no spikelet but a prophyll situated in the axils of all the branches 13. *S. prophyllata*

12. Inflorescence once to twice branched, one or more spikelets in the axils of all the branches :

13. Female glumes 1·5–2 mm. long, sometimes minutely hispidulous, reddish-black ; achene 1·2–1·4 mm. long ; inflorescence twice branched 12. *S. poaeoides*

13. Female glumes 2·5–4 mm. long, glabrous, pale with reddish or reddish-black streaks or patches ; achene 1·3–2 mm. long :

14. Inflorescence 8–20 cm. long, very lax, once and sometimes twice branched ; achene usually transversely verrucose or trabeculate but sometimes slightly tubercled-lacunose . . . . . 7. *S. woodii*

14. Inflorescence 3·5–10 cm. long, not or not very lax ; achene from nearly smooth to tuberculate or muricate-lacunose :

15. Leaves 2·5–4·75 mm. wide ; inflorescence once branched ; achene nearly smooth to subdensely tuberculate 6. *S. holcoides*

15. Leaves 1·5–3 mm. wide ; inflorescence once, rarely twice, branched ; achene nearly smooth to muricate-lacunose 8. *S. striatonux*

11. Inflorescence simply glomerate-spicate or from 1–few of the lower glomerules shortly once branched :

16. Female glumes hispidulous or villous :

17. Glomerules 8–17, each composed of 2–6 spikelets which are 3–4 mm. long ; female glumes 2·25–2·5 mm. long 11. *S. lateritica*

17. Glomerules 5–10, each composed of 1–3 spikelets which are 4·75–6 mm. long ; female glumes 3·25–3·5 mm. long . . . 9. *S. flexuosa*

16. Female glumes glabrous :

18. Spikelets 4·5–6 mm. long ; female glumes blackish-red or dark reddish brown ; achene smooth, tubercled, or trabeculate 5. *S. dregeana*

18. Spikelets 4–5 mm. long ; female glumes pale greenish with castaneous sides ; achene smooth 10. *S. meyeriana*

B. Annuals with fibrous roots and no rhizome.

19. Glomerules reflexed :

20. Glomerules single, sessile . . . . . 32. *S. melanotricha*

20. Glomerules sometimes single but mostly binate, shortly but distinctly peduncled . . . . . 33. *S. grata*

19. Glomerules not reflexed :

21. Inflorescence more or less branched :

22. Whole plant completely glabrous ; inflorescence conspicuously and twice branched . . . . . 14. *S. glabra*

22. Plants not completely glabrous ; inflorescence only sometimes and only once branched :

23. Inflorescence 3–10 cm. long, often unbranched ; female glumes blackish bristly-hairy :

24. Plant very hairy ; female glumes covered with blackish hairs ; achene rugose-trabeculate 15. *S. hispidior*

24. Plant sparsely hairy ; female glumes glabrous except for a few blackish hairs on the midrib above ; achene tessellate . . . . . 16. *S. hispidula*

23. Inflorescence 1–4 cm. long ; female glumes glabrous :

25. Inflorescence always branched ; stems 18–25 cm. tall ; glomerules 1–2 mm. broad ; spikelets single below ; female glumes wholly pale or streaked dull reddish . . . . . 21. *S. suaveolens*

25. Inflorescence sometimes unbranched ; stems 8–15 cm. tall ; glomerules 2–7 mm. broad ; each consisting of several spikelets ; female glumes wholly blackish-red . . . . . 22. *S. pulchella*

21. Inflorescence simply glomerate-spicate :

26. Female glumes hairy, at least on the midrib and awn :

27. Plants rather densely hairy ; female glumes wholly hairy :

28. Mouth of leaf-sheath truncate-concave ; inflorescence sometimes branched below ; 3–7 cm. long ; female glumes covered with blackish bristle-like hairs . 15. *S. hispidior*

28. Mouth of leaf-sheath subtruncate to convex ; inflorescence never branched, simply glomerate-spicate, 6–15 cm. long ; female glumes more or less villous . . . 24. *S. bicolor*

27. Plants sparsely hairy ; female glumes hairy only on the midrib and awn :

29. Glomerules 3–4, 5–10 mm. broad ; spikelets 4–6 mm. long ; female glumes 3–3·75 mm. long ; achene about 2 mm. long
27. *S. glomerulata*

29. Glomerules 4–15, 2·5–8 mm. broad ; spikelets 3–4 mm. long ; female glumes 2–3 mm. long ; achene 1·4–1·5 mm. long :

30. Inflorescence sometimes branched below; awn of bracteole reddish spinulose-ciliate at the apex ; achene tessellate
16. *S. hispidula*

30. Inflorescence never branched, simply glomerate-spicate ; awn of bracteole whitish-ciliate above ; achene trabeculate or lacunose-trabeculate
28. *S. tricholepis*

26. Female glumes glabrous, even on the midrib and awn :

31. Plant completely glabrous ; spikelets 5–6 mm. long ; female glumes 3·5–4 mm. long . . . 25. *S. ustulata*

31. Plant sometimes hairy on the leaf-sheaths ; spikelets 2–5 mm. long ; female glumes 1·5–3·25 mm. long :

32. Leaves 0·5–1 mm. wide ; female glumes in only one species yellowish-green with a blackish apical tip and male glumes in only the other species covered with dark reddish-brown streaks :

33. Glomerules composed of 2–6 spikelets ; female glumes yellowish-green with a blackish apical tip
29. *S. spondylogona*

33. Glomerules composed of 1–3 spikelets ; male glumes thickly covered with dark reddish brown streaks on a lighter ground colour
30. *S. delicatula*

32. Leaves 1–2·25 mm. wide ; female and male glumes not as above :

34. Stems 8–15 cm. tall ; inflorescence 1–4 cm. long, sometimes shortly branched below; spikelets 2–4 mm. long
22. *S. pulchella*

34. Stems 15–95 cm. tall ; inflorescence 2–13 cm. long, never branched ; spikelets 4–5 mm. long :

35. Mouth of leaf-sheath densely villous ; achene 1·9–2 mm. long . . . 23. *S. remota*

35. Mouth of leaf-sheath glabrous ; achene 1·4–1·6 mm. long :

36. Inflorescence 5–13 cm. long ; bracteoles about as long as or a little longer than the glomerules, not aristate . 26. *S. pergracilis* var. *pergracilis*

36. Inflorescence 2-6 cm. long; bracteoles longer to much longer than the glomerules, some shortly to longly aristate . 26. *S. pergracilis* var. *brachystachys*

1. **Scleria lithosperma** (*L.*) *Swartz*, Prodr. Veg. Ind. Occ. 18 (1788) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 502 (1902) ; C. B. Clarke, Illustr. Cyper. t. 123 (1909) ; Hutch. & Dalz., Fl. W. Trop. Afr. 2 : 491, 493 (1936) ; Core in Brittonia, 2 : 27, t. 3, fig. 2 (1936) ; Piérart in Lejeunia, Mém. 13 : 34, t. 4, fig. 9 (1953).

Scirpus lithospermus L., Sp. Pl. ed. 1, 51 (1753), in part.—Hab. in India.

Scleria puzzolanea K. Schum. in Engl. Pflanzenw. Ost.-Afr. C : 129 (1895).—Tanganyika, *Holst* 2797.

A tall and slender, slightly hairy, tufted perennial, with a loose, thin, more or less compound panicle of spikelets. *Rhizome* extremely short, not extending far in any one direction, more or less 2 mm. thick. *Stems* erect, tufted or densely tufted, 35–85 cm. tall, 1·25-1·75 mm. thick, glabrous throughout. *Leaves* 2–5 mm. wide, usually revolute or plicate or otherwise rolled or folded, less commonly flat or flattish, glabrous or sparsely villous, lower reduced to bladeless or nearly bladeless sheaths ; *sheaths* glabrous or minutely pubescent, lower brownish or dull reddish brown, mouth more or less produced into a triangular or ovate, obtuse, densely hairy tongue, up to about 2 mm. long. *Inflorescence* composed of a terminal and several bracteate axillary panicles, which are weak but usually lower ones branched, sometimes reduced to one axis bearing several sessile spikes. *Panicles* with a main axis 3 -15 cm. long, composed of 4–10 glomerules of 1–3 spikelets and often from the lower 1 4 glomerules arise glomerate-spicate branches bearing 1–3 glomerules similar to those on the main axis, upper glomerules from subcontiguous to several times

their own distance apart on the axis, lower much more distant from one another, glomerules erect but spikelets somewhat spreading, 1–6 mm. broad ; *spikelets* 4–5 mm. long. *Bracts* foliaceous or subfoliaceous, usually much exceeding their panicles, those of the lateral panicles shortly to longly sheathing. *Bracteoles* glumiform at the base but mainly setaceous and usually much longer than the glomerule, somewhat complanate and minutely scaberulous on the margins, usually more or less curved. *Lower empty glumes* often similar to the bracteoles. *Female glumes* 3–3·5 mm. long, glabrous, greenish or pale flushed brownish to wholly brownish, midrib excurrent in a smooth mucro or awn 0·5–4 mm. long ; *male glumes* 3–4 mm. long, glabrous, wholly brownish, midrib not or scarcely excurrent. *Achene* ovoid or ellipsoid, sometimes ellipsoid-obovoid, obtusely trigonous, 2·5–3 mm. long, 1·75–2 mm. broad, pearly white, very shortly beaked.

Gold Coast : Krobo Girls' School, Odumase, in secondary clearings on old farms, June 1931, *Irvine* 1644 (K).

Belgian Congo : Ituri, Kada, Lake Albert, in forest, 630 m., 22 Aug. 1935, *H. B. Johnston* 1053 (K).

Kenya : Mombasa, Rabai Hills, 1886, *W. E. Taylor* (BM) ; Kwale District ; Cha Simba Forest, Kwale, 300 m., open areas in recently felled forest, also seen in forest in deep shade, 1 Feb. 1953, *Drummond & Hemsley* 1083 (K).

Tanganyika : Amboni, in scrub, June 1893, *Holst* 2797 (K) ; Dar es Salaam, Sachsenwald, wet places, 14 June 1902, *Holst* 526 (EA) ; W. Usambaras, Mlalo, in woodland of the Kumuschu valley, *Holst* 542 (PRE) ; E. Usambaras, Maramba to Lugongo, primitive forest, 280 m., 16 June 1917, *Peter* 20996 (EA) ; Kilosa, common in deep shady glen in *Brachystegia* hills, 23 Jan. 1926, *B. D. Burtt* 38 (K) ; E. Usambaras, Tongwe Mtn., 600 m., locally dominant with *Panicum pleianthum* in the more open parts . . . of evergreen forest on a dark grey sandy loam, 22 Sept. 1940, *Greenway* 6027 (EA, K) ; ibid., summit of Tongwe Mtn., gneiss rocks with grey sandy loam, dry evergreen forest surrounded by coarse grassland, frequent, 600 m., 15 June 1950, *Verdcourt & Greenway* 259 (EA, K) ; Tanga District, Kange Estate, in sandy soil in lately cleared forest, common, 60 m., 19 Jan. 1952, *Helen Faulkner* 873 (K) ; E. Ulugurus, Kimboza, forest, 540 m., 2 April, 1954, *Padua* 332 (EA, K).

Pemba : Chake Chake, 18 Aug. 1929, *Vaughan* 522 (EA, K).

Portuguese E. Africa : near Beira, 60 m., 10 April 1898, *Schlechter* 12241 (PRE).

Pantropical.

I have not seen the following Tanganyika numbers of *S. lithosperma*, mostly collected and determined by Peter (Fedde, Rep. Spec. Nov. Beih. XL., 1 : 532 : 1938). The determinations have been confirmed by Kükenthal.

Tanga District ; Maramba to Marimba, 280 m., *Peter* 20546 ; Maramba to Tanga, 280 m., *Peter* 21216 ; Maramba to Lugongo, 280 m., *Peter* 22426 ; Ukereni hills, near Amboni, 80 m., *Peter* 24113 ; Muera, ravine by stream, near Langoni, *Peter* 38890 ; Amboni, *Holst* 2792. Uzaramo District ; Dar es Salaam, Sachsenwald, *Holst* 526. Lushoto District ; W. Usambaras, Mlalo, in woodland of the Kumuschua valley, *Holst* 542.

This species has characters which connect it with both Sect. *Hypoporum* and Sect. *Euscleria*. It is here included in Sect. *Hypoporum* on account of its androgynaeceous spikelets, though in some specimens these are reduced to female ones, and it also has the narrow non-scabrid leaves of this Section. It deviates from Sect. *Hypoporum* in its lateral, leafy-bracteate partial inflorescences.

2. **Scleria lacustris** *Wright ex Sauvalle* in Anal. Acad. Cienc. Habana, 8 : 152 (1871).—Cuba, *Wright.*

Scleria aquatica Cherm. in Bull. Soc. Bot. France, 77 : 279 (1930) ;

Piérart in Lejeunia, Mém. 13 : 33 (incl. distrib. map), t. 1, figs. 20–23 (1953).—Gabon, *Le Testu* 5708, 5964.

A tall and stout, aquatic, glabrous perennial rooting at one to several lower nodes of a descending basal part of the stem and bearing a several times branched inflorescence. *Rhizomatoid stem* base erect-descending, more or less angled, 5–12 mm. thick. *Stems* 60–160 cm. tall, 7–12 mm. thick above the base, angles spinulose from the base upwards and including the rhachis and its branches, 10–15 mm. wide, flat or flattish, glabrous, scabrid on the margins, on the midrib of the under-surface and, in places, on the two sub-marginal ribs on the upper surface ; *sheaths* glabrous, scabrid as the leaves, mouth strongly prolonged into a tongue, which is rounded at the membranous apex and 5–10 mm. long. *Inflorescence* with its main axis 15–30 cm. long, bearing 8–15 sessile glomerules each composed of 1–4 spikelets, and from the lower 3–8 glomerules arise glomerate-spicate branches bearing 2–12 glomerules similar to those on the main axis, lower branches sometimes again branched, upper glomerules, on main axis and branches, from subcontiguous to 3 cm. distant from one another, lower much more distantly spaced (1·5–5 cm.), glomerules erect, 2–6 mm. broad ; *spikelets* 5–6 mm. long. *Bracteoles* all setaceous and from twice as long as the glomerules to about 8 cm. long, straightish or somewhat curved, or, less commonly, lowest subfoliaceous and up to 15 cm. or more long. *Female glumes* 3–5 mm. long, glabrous, dark brownish-red or blackish-red, including the midrib, midrib excurrent in an awn 0·25–1 mm. long ; *male glumes* similar to the female but 4–4·5 mm. long and sometimes mucronulate, mucro up to 0·5 mm. long. *Achene* ellipsoid or ovoid-ellipsoid, obtusely to obscurely trigonous, 3–3·5 mm. long, 2–2·5 mm. broad, smooth and shining, white or whitish, not beaked nor stipitate.

Sierra Leone : Njala, edge of marsh, tufted with about six tillers, only one plant found and only one previously seen, evidently not very common, 1 Feb. 1933, *Deighton* 2597 (K) ; marsh Nganyshun (between Senihum and Njala), commonest plant in the marsh, 26 Sept. 1935, *Deighton* 3074 (K) ; Gbongome (Kori), in swamp near river, 22 June 1952, *Deighton* 5846 (K) ; Rosino, Samu, in deep water swamp, 3 Oct. 1952, *Jordan* 797 (K).

Gabon : Sainte-Croix des Echiras, stagnant pools on Ndolo plain, by more than a metre of water, Dec. 1925, *Le Testu* 5845 (Le T, P).

Belgian Congo : Ubangi District ; Lake Batuli, between Libenge and Bosbolo, Aug. 1938, *Gilbert* 1814 (BR).

Cuba, French Guiana.

This species retains its place in Sect. *Hypoporum* by virtue of its androgynaeceous spikelets, but it shows evidence of its relationship with other sections of the genus in its spinulose-angled stems, wide scabrid leaves, long-tongued sheaths, comparatively large achenes, and slightly 3-lobed hypogynous disc, characters not met with throughout the rest of the Section.

In Core's revision of American *Scleria* (Brittonia, 2 : 1936) *S. lacustris* is said to be " apparently endemic to Cuba ". It is therefore surprising to find it conspecific with *S. aquatica*, which Chermezon described from Gabon and which occurs also in Sierra Leone and the Belgian Congo. There is also a specimen at Kew from French Guiana.

3. **Scleria welwitschii** *C. B. Clarke* in Durand & Schinz, Consp. Fl. Afr. 5 : 675 (1895), et in Dyer, Fl. Trop. Afr. 8 : 501 (1902).—New name for *S. junciformis* Welw. ex Ridley.

Scleria junciformis Welw. ex Ridley in Trans. Linn. Soc., ser. 2, Bot. 2 : 168 (1884), non Thwaites (1864).—Angola, *Welwitsch* 7138, 7139.

A tall and somewhat slender, glabrous or hairy perennial with a stoutish rhizome with shortish internodes and with a usually branched inflorescence. *Rhizome* horizontally creeping, 2–5 mm. thick, pale fulvous, clothed with stramineous-reddish sheathing scales. *Stems* 30–97 cm. tall, 1–1·75 mm. thick, glabrous or glabrate throughout or, sometimes, sparsely villous, especially on the rhachis. *Leaves* 2–3 mm. wide, flat to plicate-revolute or more or less folded, glabrous to densely villous ; *sheaths* glabrous to densely villous, lower sometimes slightly to considerably dull reddish, mouth produced into a triangular or apically rounded, glabrous to densely villous tongue, 0·5–1·5 (lower up to 3) mm. long. *Inflorescence* with its main axis 3–27 cm. long, composed of 3–8 sessile glomerules of 1–6 spikelets, and from the lower (0) 1–4 glomerules arise glomerate-spicate branches bearing 1–3 glomerules similar to those on the main axis, upper glomerules, on the main axis and branches, subcontiguous to once to three times their own length apart on the axis, lower much more distant (2–10 cm.) from one another, glomerules erect, 1–10 mm. broad ; *spikelets* 5–7 mm. long. *Bracteoles* glumiform with a long smooth or sparsely ciliolate awn often shorter than the glomerule and straight but sometimes quite as long and curved. *Female glumes* 3–4 mm. long, glabrous or slightly hairy on the midrib above, pale with greenish midrib and fulvous streaks and patches on the sides, midrib excurrent in a smooth or scaberulous awn 0·25–0·5 mm. long ; *male glumes* 4·5–5 mm. long, glabrous, mostly wholly fulvous to reddish-castaneous, usually muticous. *Achene* ellipsoid or ovoid, obtusely to obscurely trigonous, 1·8–1·9 mm. long, 1–1·2 mm. broad, shining white, smooth, extremely shortly beaked.

Southern Rhodesia : Salisbury District ; Salisbury, in swamp, 1440 m., 30 Jan. 1927, *Eyles* 4679 (K) ; Marandellas District ; grasslands, vlei, 1500 m., 17 Oct. 1948, *Corby* 155 (Gov. Herb. No. 24848) (K).

Angola : Huilla ; deep grass-grown wooded meadows near Catumba, end of March 1860, *Welwitsch* 7138 (BM, LISU).

Transvaal : Witwatersrand Division ; Witpoortje Kloof, vlei, 4 Feb. 1922, *Moss* 6583 (K) ; ibid., edge of marsh, 18 Nov. 1923, *Moss* 8348 (K) ; Pietersburg District ; Woodbush, Mountain Home Farm, 1530 m., common in marshes with *Platanthera zeyheri*, 18 Dec. 1935, *Mogg* 14681 (PRE).

Natal : Glencoe, Biggarsberg, 1200–1500 m., 23 Feb. 1893, *Medley Wood* 4757 (spikelets abnormally thickened and elongated) (K) ; Bergville District ; Cathedral Peak Forest Res. Stn., locally dominant in part of vlei in Catchment 6, 1815 m., 20 Dec. 1950, *Killick* 1233 (EA, K, PRE).

Ridley (Trans. Linn. Soc., ser. 2, Bot. 2 : 168 : 1884) described *Scleria junciformis* from the two gatherings, *Welwitsch* 7138 and 7139. The description applies about equally well to each of these numbers, which I consider to be distinct species. C. B. Clarke, in Dyer, Fl. Trop. Afr. 8 : 501 (1902), dealing with these numbers, retains them under *S. welwitschii*, but takes his key character, " spikelets $\frac{1}{4}$ in. long ", from no. 7138. On the same page he includes the recently described species, *S. rehmannii*, based on *Rehmann* 5626, collected in the Transvaal, to which species *Welwitsch* 7139 belongs. The species represented by *Welwitsch* 7138 does not appear to have been described before Ridley and Clarke did so. There seem good reasons, therefore, for choosing *Welwitsch* 7138 as the lectotype of *Scleria welwitschii* C. B. Clarke which I here now do.

This species is very close to *S. spicata* (Spreng.) F. Macbride, 1929, (*Rhynchospora spicata* Spreng., 1825), a Brazilian plant, which, however, differs in having a thickened stem-base and there may be other differences which the poor American specimens at Kew do not reveal. I therefore venture to treat the Brazilian plant as a species distinct from the African *S. welwitschii*.

Piérart, in his account of the Belgian Congo species of *Scleria* (Lejeunia, Mém. 13 : 30–31 : 1953), having a specimen of *S. rehmannii* C. B. Clarke to consider, (*Quarré* 3653), misidentifies it as *S. welwitschii*.

4. **Scleria rehmannii** *C. B. Clarke* in Dyer, Fl. Cap. 7 : 295 (1898) ; et in Dyer, Fl. Trop. Afr. 8 : 501 (1902).—Transvaal, *Rehmann* 5626.

? *Scleria kindtiana* Graebn. in Fedde, Repert. 16 : 24 (1919).—Angola, *De Kindt*.

Scleria welwitschii var. *tuberculata* Cherm. in Arch. Bot. Caen., VII, Mém. 3 : 13 (1936).—Ubangi-Shari, *Tisserant* 2922.

A tall and rather slender, hairy-leaved perennial, with a stout pale rhizome, from which the stems arise well spaced and in succession, and a branched inflorescence. *Rhizome* more or less horizontal, longly creeping, 4–6 mm. thick, pale dull yellowish when its sheathing scales are shed. *Stems* 30–150 cm. tall, 1–2·25 mm. thick, glabrous, including the rhachis. *Leaves* 1·5–3·5 mm. wide, mostly plicate-revolute or otherwise folded, sparsely to densely villous, rarely glabrate, lower reduced to shortly and scarcely bladed sheaths ; *sheaths* more or less densely villous, mouth of at least lower sheaths usually produced into a triangular tongue, 1–2 mm. long. *Inflorescence* with its main axis 3–17 cm. long, bearing 4–12 glomerules, each composed 1–6 sessile clustered spikelets, and usually from the lower 1–7 glomerules arise glomerate-spicate branches, each bearing 1–7 glomerules similar to those on the main axis, the upper ones usually from contiguous to not more than their own length apart, the lower ones frequently 1–2 (4) cm. apart, erect, 2–9 mm. broad ; *spikelets* 4–5 mm. long. *Bracteoles* glumiform below, longly aristate and glabrous to minutely scaberulous above, up to about as long as the glomerules, inconspicuous. *Female glumes* 2–3 mm. long, glabrous, pale or light reddish streaked dark reddish-brown or wholly bright blackish-red, muticous or midrib excurrent up to 1 mm. long ; *male glumes* similar but 2·5–4·5 mm. long. *Achene* ovoid-globose or depressed-globose, obtusely to obscurely trigonous, 1·25–2 mm. long, 1·2–1·6 mm. broad, smooth and rather shiny white or densely trabecular-tubercled, very shortly beaked.

Ubangi-Shari : Bozoum, marsh, Oct. 1931, *Tisserant* 2922 (P).

Belgian Congo : Katanga pastures of the Karavia, in damp soil, Dec. 1933, *Quarré* 3653 (BR) ; ibid., Kipopo, 25 km. W.N.W. of Elizabethville, natural savannah in a valley inundated after the great rains, 23 Nov. 1952, *Schmitz* 4220 (BM, BR, K).

Tanganyika : Kwa Mtumbo, E. Ungoni, 1900–01, *Busse* 777 (EA).

Portuguese E. Africa : Manica, between Moribane and Matarara do Lucite, 8 Oct. 1953, *Gomes Pedro* 4241 (PRE).

Nyasaland : " Scleria setulosa Bcklr. n. sp. " Shire Highlands, *Buchanan* (E) ; [without precise locality] 1891, *Buchanan* 471 (BM, E, K), 1424, 1435, 1438B, 1452B (all K) ; Shire Highlands, Mandala, Dec. 1893, *Scott Elliot* 8507 (BM, K) ; Shire Highlands, *Adamson* 109, in part (K).

Southern Rhodesia : Matopa Hills, granite, 1500 m., Nov. 1902, *Eyles* 1107 (BM) ; Inyanga District ; in a wet place near the Niarerne streamlet, c. 1700 m. 20 Jan. 1931,

Norlindh & Weimarck 4471 (BM) ; Marandellas District, Machonaland, Cave Farm, Feb.–March 1946, *Weber* 227 (K) ; grasslands, widespread, 1500 m., 15 Jan. 1948, *Colvile* 33 (Gov. Herb. No. 18653) (K) ; ibid, often very dominant in moist to wet vlei soil, not in permanent standing or running water, 1500 m., Jan.–Feb. 1948, *Colvile* 58 (G.H. No. 18844) (K) ; ibid., 21 Feb. 1948, *Colvile* (G.H. No. 18895) (K) ; ibid., leaves lemon-scented when crushed, 20 March 1948, *Corby* 48 (G.H. No. 20899) (K). Miami District ; K 34 Farm, at vlei edge in seepage area on stony ground, 1350 m., 4 March 1947, *Wild* 1754 (G.H. No. 15858) (K).

Northern Rhodesia : Ndola District ; near Mufulira, grey clayey sand, dambo, 1200 m. or more, Jan. 1934, *Trapnell* 1644 (K) ; Abercorn District ; Lake Chila, in sandy soil, edge of peat bog, marsh by lake, 1560 m., 25 Jan. 1952, *Mrs. H. M. Richards* 580 (K) ; Muckle Neuk, 12 m. N. of Choka, dambo, 1230 m., 13 Jan. 1954, *Robinson* 457 (K).

Angola : Huilla ; plentiful in marshy meadows, from Monino on the way to Eme, Jan. & Feb. 1860, *Welwitsch* 7139 (BM, LISU) ; [without precise locality], *Gossweiler* 2383 (K) ; Monnyino, 1760 m., *De Kindt* 402 (not seen).

South Africa : Transvaal ; Houtbosh, 1875–1880, *Rehmann* 5626 (K).

C. B. Clarke described *Scleria rehmannii* in Fl. Cap. from Rehmann's no. 5626, which has smooth fruits. Later, in Fl. Trop. Afr., he had several Buchanan numbers from Nyasaland which appeared to belong to *S. rehmannii*, but some had tubercled fruits, which Clarke obviously felt excluded them from this species. These he placed hesitantly under *S. glabra*, with which apart from the fruit they did not agree, and the smooth-fruited numbers were put to *S. rehmannii*. Difficulty which Clarke did not resolve arose from Buchanan's numbers 471 and 1452B, because almost certainly the gatherings of each of these contained both smooth and tubercled-fruited plants. He notes on the sheet on which both these numbers are mounted : " There was either an original mixture of these numbers in the collections or I made a mistake in laying out ". It did not occur to him as a possibility that one species could contain both smooth and rough fruited individuals. *Buchanan* 471 was finally considered by Clarke to be smooth fruited, he having thrown out into 1452E the, as he thought, intruding rough fruited plants, thus making the number agree with *S. rehmannii*. No 1452B therefore became wholly rough fruited, and no doubt with something akin to despair, Clarke placed it under *S. poaeoides* Ridley, a species with which it has no close affinity.

For a note on the above-cited Angolan plant, *Welwitsch* 7139, see under *S. welwitschii*.

5. **Scleria dregeana** *Kunth*, Enum. Pl. 2 : 354 (1837) ; C. B. Clarke in Dyer, Fl. Cap. 7 : 295 (1898) ; et in Dyer, Fl. Trop. Afr. 8 : 499 (1902).—South Africa, *Drège*.

Scleria caespitosa Welw. ex Ridley in Trans. Linn. Soc., ser. 2, Bot. 2 : 167 (1884).—Angola, *Welwitsch* 7135.

Scleria setulosa Boeck., Cyper. Nov. 1 : 33 (1888).—Nyasaland, *Buchanan* 36.

A tall, slender, glabrescent to villous, rhizomatous perennial with stems thickened but not bulbous at the base. *Rhizome* very short, 1·5–2·25 mm. thick. *Stems* 23–100 cm. tall, glabrous throughout, even on the rhachis. *Leaves* 1–2·75 mm. wide, thickish, flattish-plicate or conduplicate, glabrescent to villous, lower reduced, lowest to bladeless sheaths ; *sheaths* glabrous to densely villous, mouth more or less truncate, glabrous to densely villous. *Inflorescence* 2–10 cm. long, glomerules 3–11, each

composed of about 3–8 spikelets, upper rarely all contiguous, lower or lowest more spaced, up to 1–2 cm. from one another, rarely lowest or lower 1–2 with another glomerule on a short to long peduncle, sessile, erect or suberect, 3–10 mm. broad ; *spikelets* 4·5–6 mm. long. *Bracteoles* glumiform and glabrous below, aristate and usually minutely scaberulous-margined above, awn straight to curved, from shorter to somewhat longer than their glomerules. *Female glumes* 2·25–3 mm. long, glabrous, blackish-red or dark reddish-brown, midrib often widely green, 0–0·5 mm. excurrent ; *male glumes* similar but rather longer and more completely coloured, sometimes pale or greenish, including the midrib which is not so frequently excurrent. *Achene* ovoid, ellipsoid, hemispherical, or subglobose, very obtusely trigonous, 1·5–2 mm. long, 1·1–1·3 mm. broad, from smooth and shining through tuberculate to trabeculate, white, moderately to shortly beaked.

Nyasaland : Manganja Hills, near Soche Hill, 900 m., 8 March 1862, *Kirk* (K) ; Shire Highlands ; *Buchanan* 36 (K) ; Kanyaloma, Kirk Range, 16 Nov. 1950, *G. Jackson* 281 (EA, K).

Southern Rhodesia : Marandellas District ; Grasslands, in vlei, 1500 m., Jan. 1948, *Colvile* 38 (Gov. Herb. No. 18628) (K) ; ibid ; on vlei-like ledge above stream, 1–2 ft. above permanent water level, lemon scented with slight *Eucalyptus* tang, 1500 m., 21 Feb. 1948, *Colvile* 79 (G.H. No. 18900) (K).

Northern Rhodesia : Ndola ; Itawa Dambo, fairly wet area, forming a dense mat all seeming to lie in one direction, 25 May 1950, *G. Jackson* 31 (K).

Angola : Pungo Andongo ; higher damp slopes of Funda-Quilombo in the praesidium, April 1857, *Welwitsch* 7131, partly, (BM) ; ibid ; plentiful in marshy wooded meadows between Condo and Quisonde, March 1857, *Welwitsch* 7135 (BM, K, LISU) ; Huilla ; in the deeply herb-grown woods of Monino, seen only in one place, end of Jan. 1860, *Welwitsch* 7137, partly (BM, LISU) ; Mossamedes District, on both marshy plains of Humpata, common, March 1884, *Newton* 6 (BM, COI).

Transvaal : valley stream near Kloete's Farm, Oct. 18, *Wilms* 1586 (K) ; damp place near Pretoria, 1410 m., 15 Nov. 1893, *Schlechter* 3705 (K) ; near Pretoria, 15 Nov. 1893, *Schlechter* 5496 (PRE) ; Pretoria, Fairy Glen, 11 Nov. 1908, *Leendertz* 6213 (PRE) ; Pyramid Estate, near Potgietersrust, marshy plateau on summit of granite mts., 1650 m., 1 March 1921, *Galpin* 9104 (PRE) ; Donkerspoort, 20 miles E. of Pretoria, 23 March 1938, *Doidge & Bottomley* (PRE) ; Pretoria, Rietvlei Reserve, S. end, black soil, 1500 m., 27 Feb. 1947, *Repton* 3295 (PRE) ; about 9 miles W. of Krugersdorp, on Gladysvale Farm, moist place near stream, basically dolomites and limestones, deep humus in many places, 28 Feb. 1948, *Rodin* 3922 (K).

Natal : between Greytown and Newcastle, Nov. 1883, *Wilms* 2327 (K) ; Weenen District, top of Griffin's Hill, stream banks in highland sourveld, common, 29 Oct. 1944, *Acocks* 10738 (PRE) ; Impendhle, occasional among grasses on vlei edge, ± 1650 m., Dec. 1948, *Huntley* 425 (K, NU) ; Bergville District, Cathedral Peak Forest Res. Stn., locally abundant in mud on rock bed of stream in Catchment VI. 1815 m., 3 Nov. 1950, *Killick* 1084 (EA, K,NU).

Basutoland : 1861, *Cooper* 3365 (K).

Cape Province : Stockenstrom Div. ; Kat Berg, 1200–1500 m., Nov. 1840, *Drège* 3934 (K) ; Tembuland ; Baziya, 600 750 m., *Baur* 311 (K) ; Komgha Div., marshy places near Komgha, 600 m. 1892, *Flanagan* 1260 (K).

6. **Scleria holcoides** *Kunth*, Enum. Pl. 2 : 354 (1837) ; C. B. Clarke in Dyer, Fl. Cap. 296 (1898).—South Africa, *Drège*.

A comparatively robust, very sparsely villous to nearly glabrous perennial with a short stoutish rhizome. *Rhizome* with very short internodes, about 3 mm. thick, clothed with reddish-brown sheathing scales. *Stems* about 60–100 cm. tall, 1·25–2 mm. thick, glabrous, even on the rhachis, or upper angles of this minutely scaberulous. *Leaves* 2·25–4·75 mm. wide, flat to plicate-revolute, mostly glabrous or glabrate ; *sheaths* mostly glabrous, lower sometimes sparsely villous, mouth usually

sparsely villous or hirsute, more or less truncate. *Inflorescence* with its main axis 5–10 cm. long and bearing 7–11 glomerules, each composed of 2–8 sessile clustered spikelets, and from the lower 3–4 glomerules arise glomerate-spicate branches, each bearing 1–4 glomerules similar to those on the main axis, the upper ones mostly closely contiguous but sometimes up to their own length apart, lower contiguous to 2 cm. distant from one another, erect, 2–10 mm. broad ; *spikelets* 5–6 mm. long. *Bracteoles* longly aristate from a glumiform base, awn straight to curved, scaberulous or scabro-ciliate, about as long as to longer than the glomerules. *Female glumes* 2·5–3·5 mm. long, glabrous, pale or light reddish with reddish-brown lines and streaks, midrib excurrent in a smooth or minutely scaberulous awn, 0·75–1·25 mm. long ; *male glumes* similar but 3–5 mm. long, more reddish-brown, midrib muticous or up to 0·75 excurrent. *Achene* ellipsoid, obovoid-ellipsoid, or subglobose, obtusely but distinctly trigonous, 1·75–2 mm. long, 1·1–1·3 mm. broad, from nearly smooth or sparsely tuberculate to subdensely tuberculate, shining whitish, shortly beaked.

Pondoland or Natal : between Umtentu River and Umzimkulu River, below 150 m., 1840, *Drège* [4381] (K).

Natal : Durban flat [recd. June 1874], *Buchanan* 3 (K) ; [no locality mentioned, recd. Nov. 1875], *Buchanan* 349 (K).

This species differs from other members of Sect. *Hypoporum* in having some of its inflorescences very dense and some loose.

7. **Scleria woodii** *C. B. Clarke* in Dyer, Fl. Cap. 7 : 295 (1898) ; et in Dyer, Fl. Trop. Afr. 8 : 501 (1902).—Zululand, *Wood* 3994.

A very tall rather slender perennial, glabrate, or hairy below, with a slender to irregularly stoutish rhizome from which the stems arise at short or very short intervals and with a very loosely branched inflorescence. *Rhizome* horizontally or obliquely and shortly creeping, 1–1·5 mm. thick in places but swelling in other places to 3–4 mm., yellowish or pale fulvous but clothed with light reddish sheathing scales. *Stems* 35–75 cm. tall, 1–1·25 mm. thick, glabrous or rhachis sometimes sparsely scaberulous-ciliate on the angles. *Leaves* 1·75–3·25 mm. wide, flat to plicate-revolute or more or less conduplicate, glabrous ; *sheaths* glabrous except the lower which are frequently sparsely villous and more or less reddish, mouth truncate or shallowly concave and glabrous to densely hirsute or villous. *Inflorescence* with its main axis 8–20 cm. long, composed of 4–8 sessile glomerules of 1–6 clustered, crowded spikelets, the lower fewer, some reduced to a very depauperate spikelet or this has sometimes almost disappeared, and from the lower 4–8 glomerule-axils arise glomerate-spicate branches, each bearing 1–5 glomerules (some sometimes again branched), similar to those on the main axis, upper glomerules, on main axis and branches, from subcontiguous to 2 cm., lower ones up to 5 cm., distant from one another, erect, 2–8 mm. broad ; *spikelets* 4–5 mm. long. *Bracteoles* more or less glumiform and pale below, longly aristate and scaberulous or sparsely scaberulous-ciliate above, shorter to considerably longer than the glomerules, straight to much curved. *Female glumes* 2·5–3 mm. long, glabrous, pale, usually with reddish flushes or streaks, midrib excurrent in a smooth or sparsely scaberulous awn, 0·25–2 mm. long ; *male glumes* similar but 3·5–4·25 mm. long, sometimes almost wholly very

dark reddish-brown or even blackish-red, muticous or midrib excurrent up to 0·75 mm. long. *Achene* ovoid-globose or subglobose, obtusely to obscurely trigonous, 1·3–2 mm. long, 1–1·3 mm. broad, white to pale cinereous, usually strongly transversely verrucose or trabeculate, but sometimes, even on the same achene, lightly tubercled-lacunose in places, very shortly beaked.

Tanganyika : Rungwe District ; Konda, Kyimbila, in grassy fields, 1000 m., *Stolz* 997 (PRE).

Southern Rhodesia : Hartley District ; Poole, common on poor wet sandy soil with *Loudetia simplex* and *Microchloa indica*, 1200 m., 15 Feb. 1946, *Hornby* 2435 (G.H. No. 14666) (K). District Marandellas ; Grasslands, *Loudetia* veld, 1500 m., 3 Dec. 1948, *Corby* 277 (G.H. No. 24881) (K) ; ibid., Grasslands, *Chloridion* veld, 1500 m., 1 Jan. 1949, *Corby* 325 (G.H. No. 24898) (K).

Northern Rhodesia : Abercorn District ; Lunzua Valley, beyond village, in boggy ground among grass, 900 m., 6 Feb. 1952, *Mrs. H. M. Richards* 628 (K).

Angola : meadows near the bank of the river Quipumpunhime, Sobato de Humpata, beginning of April 1860, *Welwitsch* 7140 (BM, LISU).

Transvaal : Vereeniging District ; Jan. 1923, *Brandmuller* 48 (PRE) ; Johannesburg ; Houghton Estate, vlei, 25 Feb. 1923, *Moss* (K) ; Waterberg District ; Nooitgedacht, *Acocks & Naude* Y6 (PRE) ; Pretoria District ; Rietvallei 221, N. portion, margin of seepage in N.W. corner, rare, spreading into big clumps, heads aromatic, 1500 m., 21 March 1945, *Acocks* 11340 (K).

Natal : Highlands Station, 1600 m., 15 ? Sept. 1894, *O. Kuntze* (K) ; Lions River District ; Lidgetton, *Mogg* 896 (PRE) ; Bergville District ; Cathedral Peak Forest Res. Stn., occasional in grass-veld near Met. Station, 1800 m., 18 Dec. 1950, *Killick* 1222 (K) ; ibid., fairly frequent in *Themeda triandra* grassveld between two cottages on Little Berg, 1810 m., 6 Jan. 1951, *Killick* 1254 (EA, K).

Zululand : near Inyoni river, 4 April 1888, *Wood* 3994 (K).

Orange Free State : Drakensberg, near Harrismith, Feb. 1877, *Buchanan* 114 (K).

Cape Province : Kentani District, among coarse valley grasses, 360 m., 13 Feb. 1907, *Alice Pegler* 1421 (K) ; ibid., among coarse valley grasses, 360 m., Feb. 1909, *A. Pegler* 1498 (K).

I have not seen the following numbers, collected in Tanganyika by Peter and Schlieben and determined by Peter as *S. woodii* (Fedde, Rep. Spec. Nov. Beih. XL, 1 : 532 : 1938). Kükenthal confirmed Peter's naming but it seems probable that many of the specimens are *S. striatonux* De Wild.

Ulanga District ; Mahenge, savannah, solitary among grass, 1000 m., *Schlieben* 1595a, 1618a. Iringa District ; Lupembe, *Schlieben* 231, 2105. Lushoto District ; E. Usambaras, high meadows near Monga, 1000–1150 m., *Peter* 3414, 16970, 22650, 23503, 40124. Tabora District ; Ngulu, wet meadows near Goweke, 1210 m., *Peter* 45901 ; from Pori S.E. towards Goweko, 1180 m., *Peter* 35102 ; ibid., 1200 m., *Peter* 34881. Tabora District ; Kombe westwards towards Usinge, 1100 m., *Peter* 35617 ; ibid., in ponds, 1100 m., *Peter* 35478.

8. **Scleria striatonux** *De Wild.* in Rev. Zool. Afr. 14 : Suppl. Bot. 22, fig. 5 (1926) et Pl. Bequaert. 4 : 237, fig. 6 (1927) ; Piérart in Lejeunia, Mém. 13 : 28, t. 1, fig. 24 (1953).—Belgian Congo, type unknown to me.

Scleria rehmannii C. B. Clarke var. *ornata* Cherm. in Bull. Jard. Bot. Brux. 13 : 283 (1935).—Belgian Congo, *Scaetta* 2373.

Scleria striatonux var. *lacunosa* Piérart in Lejeunia, Mém. 13 : 30 (1953). —Belgian Congo, *Jurion* 342 ; Urundi, *Michel et Reed* 1163 ; Kenya, *Lugard* 667B.

A tall, rather slender and except for the leaf-sheaths completely glabrous perennial, with a slender deep-seated rhizome from which the stems arise at short intervals and with a branched inflorescence. *Rhizome* horizontally or curved-obliquely and shortly creeping, 1–2 mm. thick, dull reddish-brown or lighter yellowish-brown. *Stems* 20–60 cm. tall, 1–1·8 mm. thick, glabrous, usually including the rhachis. *Leaves* 1·5–3 mm.

wide, flat to more or less involute and revolute, glabrous, lower reduced to shortly and scarcely bladed sheaths ; *sheaths* glabrous, except the lowest almost bladeless ones, which are more or less reddish and vinaceous and sometimes minutely hispidulous, and except for the more or less truncate mouth, which is densely hispid, as is also sometimes a narrow area from the mouth down towards the node. *Inflorescence* with the main axis 3·5–10 cm. long, composed of 6 9 sessile glomerules of 1–5 clustered crowded spikelets, from the lower 2–4 glomerules arise glomerate-spicate branches, each bearing 1–5 glomerules similar to those on the main axis (sometimes again branched), upper glomerules from contiguous to not more than their own length distant, the lower ones frequently from 0·5–3 cm. distant, erect but spikelets somewhat spreading, 1–6 mm. broad ; *spikelets* 4–5 mm. long. *Bracteoles* glumiform and pale below, longly aristate and glabrous to sparsely scaberulous above, usually shorter than the glomerules, inconspicuous. *Female glumes* 3–4 mm. long, glabrous, pale or stramineous with reddish or blackish-red streaks or patches, midrib greenish, apex acute, midrib excurrent in a glabrous to slightly ciliate awn 0·25–1·25 mm. long ; *male glumes* 4·5–5·25 mm. long, glabrous, palish with streaks and often large blackish-red patches, midrib often yellowish, apex obtuse, midrib excurrent in a glabrous awn 0·25–0·75 mm. long. *Achene* ovoid-globose or subglobose, obtusely or obscurely trigonous, 1·5–2 mm. long, 1·1–1·4 mm. broad, white, glabrous, faintly tessellate, the longitudinal lines rather more clearly produced, perhaps, than the transverse ones, to muricate-lacunose, shortly or very shortly beaked.

Nigeria : N. Nigeria ; Naraguta, 21 June 1921, *Lely* 299 (K) ; ibid., plain between Bukuru and Hepham, 1290 m., 4 July 1921, *Lely* 348 (K) ; ibid., Bauchi Plateau, in short grasslands, common May 1930, *Lely* 292 (K) ; ibid., Zaria Province ; Anara Forest Reserve, Kan Gimi, open *Isoberlinia doka* woodland on ironstone soil, 10 May 1948, *Keay* (FHI 22936) (K) ; ibid., B. Gwari District ; Mando Forest Reserve, Gayam, waste ground in farm-land with *Lophiro alata* and *Detarium senegalense*, 4 June 1950, *Keay* (FHI 25838) (K) ; Katsina Province ; Maska, grazed valley grassland with *Piliostigma thonningii* scrub, 25 June, 1950, *Keay* (FHI 25900) (K).

British Cameroons : Bamenda District ; Bum, in boggy part, 1200 m., May 1931, *Maitland* 1527 (K) ; Banso, thin soil overlying rocks in open grassland, much grazed area, rhizome smelling like cedarwood, 1800 m., July 1946, *Bumpus* (K) ; Bamenda District ; Bali-Ngemba Forest Reserve, open savannah, rocky area on hilltop close to the enumeration plot, 8 May 1951, *Ujor* (FHI 30321).

Ubangi-Shari : Balimbua, 40 km. N. of Bambari, gneiss, 27 May 1928, *Tisserant* 2511 (P).

French Congo : Brazzaville, Kenguezi, savannah with " rabougris " trees, Pangala, 17 Nov. 1930, *Babet* (P).

Belgian Congo : Kasai, Beni, grassy savannah, 3 & 6 April, 1914, *Bequaert* 3357 (BR), 3428 (BR) ; Rutshuru, steppe with *Andropogon*, 11 Sept. 1914, 19 Oct. 1914, and 29 Oct. 1914, *Bequaert* 5640, 6048, 6098 (all BR) ; Gangangala, near Leverville, Nov. 1916, *Vanderyst* 6245 (BR) ; Kabare, W. of Lake Kivu, ± 1900 m., 20 Nov. 1929, *Scaetta* 2373 (P) ; between Kingi and Busogo, grassy clearing in sclerophyllous forest, 1700–1800 m., Nov. 1937, *Lebrun* 8651 bis (BR) ; Marungu Plateau, Katanga, 1940, *Jurion* 342 (BR, K, YBI) ; pastures of the Lomami, grassy savannah, valley, sandy-clay soil, 19 Nov. 1946, *Kevers* B36 (BR) ; Kisantu, savannah, 7 Nov. 1948, *Callens* 1892 (BR) ; Urundi, Kiofi, Mosso, swamp dominated by *Loudetia kagerensis*, 13 Feb. 1952, *Reed & Michel* 1163 (BR).

Anglo-Egyptian Sudan : Equatoria Province ; Ladi, Yei River, 10 Nov. 1919, *Sillitoe* 67 (K) ; ibid., *Sillitoe* 78 (K) ; ibid., Yei District, Loka burnt savannah, occasional, *J. K. Jackson* 2279 (K).

Uganda : Namaiba hill, 1200 m., Oct. 1913, *Dümmer* 362 (BM) 363 (K) ; Bugoye, grassy hilltop, 1290 m., June 1915, *Dümmer* 2724 (K) ; Kawanda, near Kampala, swampy area but dry at collecting time, 1170–1200 m., Dec. 1935, *Chandler* 1521 (BR, K) ; W. Nile District ; Koboko, grassland, June 1938, *Hazel* 605 (K) ; ibid, valley 1 mile N.W.

of Maracha rest camp, marshy ground by small stream, common around Maracha and Orungo in marshy places, 1380 m., 3 Aug. 1953, *Chancellor* 103 (K) ; Busoga District, 5 miles E. of Namasagali, close to Kamuli road, Bugabuga Co., occasional in swamp grassland with thickets mainly on old termite mounds, seasonally waterlogged but very dry and fire swept in dry season, soil deep black swamp clay, 1050 m., 11 June 1953, *G. H. S. Wood* 975 (K).

KENYA : Mt. Elgon, 2010 m., May 1931, *Mrs. C. Lugard* 667 (K).

TANGANYIKA : Kyimbila District ; N. of Lake Nyasa, Bomalakitana, in grassy meadows, 1000 m. 17 Dec. 1911, *Stolz* 997 (K) ; Lushoto District, E. Usambaras, high meadows near Monga, in grass, 1000 m., 10 June 1916, *Peter* 16970 (EA, K). Iringa Province ; Msima Stock Farm, common on hillsides, 1932, *Emson* 361 (BR, EA, K).

NORTHERN RHODESIA : Mwinilunga District ; just E. of Mwinilunga by R. Lunga, in *Brachystegia–Isoberlinia* woodland, 2 Dec. 1937, *Milne-Redhead* 3498 (K) ; Muckle Neuk, 12 miles N. of Choka, dambo, 1230 m., 13 Jan. 1954, *E. A. Robinson* 456 (K).

ANGOLA : Pungo Andongo ; plentiful in marshy places near Quibanga, Jan. 1857, *Welwitsch* 7132 (BM, COI, LISU).

S. woodii is very nearly related to this species, differing mainly in a larger, looser inflorescence.

9. **Scleria flexuosa** *Boeck.*, Cyper. Nov. 1 : 33 (1888)—Nyasaland, *Buchanan* 60.

A tall and very slender, sparsely to more or less densely villous, probably perennial plant with erect stems. *Rhizome* not present, perhaps 0. *Stems* 25–40 cm. tall, 0·5–0·75 mm. thick, very sparsely villous in places, glabrous on the rhachis. *Leaves* 1–1·75 mm. wide, flattish to variously folded, sparsely to densely villous ; *sheaths* mostly rather densely villous, especially at the truncate mouth. *Inflorescence* 4–9 cm. long, the spikelets 1–3 together, upper separated by about their own length or subcontiguous, lower up to 2 cm. apart, sometimes lower 1–2 with another glomerule on a short peduncle, axis sometimes flexuous, glomerules 5–10, sessile, erect or suberect, 2–7 mm. broad ; *spikelets* 4·75–6 mm. long. *Bracteoles* aristate from a glumiform base, glabrous, inconspicuous. *Female glumes* 3·25–3·5 mm. long, sparsely or very sparsely villous, light reddish or fulvous with darker reddish-brown streaks, midrib concolorous, excurrent in a smooth awn, 0·25–0·5 mm. long ; *male glumes* similar but 4–4·5 mm. long, darker in colour, muticous. *Achene* (only 1 present) flattened-globose, obtusely trigonous, 1·5 mm. long, 1·1 mm. broad, undulate-trabeculate, or undulate-tuberculate, white, glabrous, beaked.

TANGANYIKA : Iringa District ; Wera " (Inst. Amani 2577) ", (det. Peter, cft. Kükenthal : not seen by me).

NYASALAND : Shire Highlands, *Buchanan* 60 (E,K.).

C. B. Clarke (Dyer, Fl. Trop. Afr. 8 : 496 : 1902) misidentified Buchan's Nyasaland plant as *S. remata* Ridley.

This species is represented by very poor material and therefore difficult to place, but it appears to be distinct.

10. **Scleria meyeriana** *Kunth*, Enum. Pl. 2 : 354 (1837) ; C. B. Clarke in Dyer, Fl. Cap. 7 : 295 (1898) ; et in Dyer, Fl. Trop. Afr. 8 : 498–499 (1902).—Pondoland, *Drège* 4364.

A medium-sized, sparsely hairy perennial with stems 25–35 cm. tall, and a very short medium-sized rhizome. *Rhizome* difficult to measure because it is so short but apparently about 3–4 mm. thick. *Stems* erect

or slightly curved, glabrous, even on the rhachis. *Leaves* 2–3 mm. wide, flat or flattish, sparsely to very sparsely villous, lower reduced to shortly bladed and bladeless sheaths ; *sheaths* mostly sparsely villous, mouth truncate and subdensely villous. *Inflorescence* 2–5 cm. long, composed of 3–5 sessile glomerules, each consisting of 3–7 sessile clustered spikelets, upper from contiguous to about their own length apart, lower from their own length to 2·3 cm. distant from each other, erect, 3–9 mm. broad ; *spikelets* 4·5 mm. long. *Bracteoles* strongly aristate from a glumiform base, awn usually minutely scaberulous, straight or curved, shorter to slightly longer than the glomerules. *Female glumes* 2·5–3 mm. long, glabrous, pale greenish including the midrib, with castaneous streaks and splashes on the sides, midrib excurrent in a smooth awn up to 1 mm. long ; *male glumes* 3–4 mm. long, glabrous, rather more coloured than the female glumes, midrib sometimes shortly excurrent. *Achene* subglobose, sometimes ovoid-globose, distinctly but obtusely trigonous, 1·5–1·8 mm. long, 1·1–1·2 mm. broad, white, smooth and shining, shortly beaked.

Bechuanaland : near the source of the Kuruman River, 25 Nov. 1812, *Burchell* 2463 (K, PRE) ; Ngamiland, Dec. 1930, *Curson* 193 (PRE). I place the Curson plant here with some doubt.

Natal : Weenen Cty. ; 1080 m., 13 Dec. 1944, *Acocks* 10850 (PRE).

Pondoland : *Drège* 4364 (not seen by me).

C. B. Clarke, in Dyer, Fl. Trop. Afr. 8 : 498 (1902), treated *S. caespitosa* Ridley, which was based on *Welwitsch* 7135, from Angola, as a synonym of *S. meyeriana* Kunth., but it seems to me to be *S. dregeana* Kunth.

11. **Scleria lateritica** *Nelmes*, sp. nov. ; affinis *S. flexuosae* Boeck. sed glomerulis magis numerosis, spiculis glumisque brevioribus praecipue differt.—Northern Rhodesia, *Milne-Redhead* 4568.

A tall, rather slender, glabrous or sparsely hairy perennial with a short slender rhizome and stems 30–65 cm. tall. *Stems* 0·5–2 mm. thick, mainly glabrous including the rhachis but sometimes sparsely villous well below the rhachis where they begin to emerge from the sheaths which hide them below. *Leaves* 0·75–2 mm. wide, flat to conduplicate, mostly sparsely villous ; *sheaths* glabrous or more or less villous, mouth of sheath shallowly concave or subtruncate. *Inflorescence* 6–10 cm. long, upper glomerules contiguous or spaced not more than twice their own length apart, lower up to 2 cm. separated from one another, 8–17, composed of 2–6 spikelets each, sometimes part of 1–several lower glomerules elongated on a peduncle up to 1 cm. long, erect or suberect ; *spikelets* 3–4 mm. long. *Bracteoles* pale or light greenish, glumiform and glabrous or sparsely hispidulous below, longly and smooth or scaberulous-margined-aristate above, shorter to about as long as but lower sometimes up to twice the length of the glomerules, awn straight or nearly so. *Female glumes* 2·25–2·5 mm. long, sparsely and minutely hispidulous at least above, streaked and splashed castaneous, midrib pale, sometimes excurrent in a fairly smooth mucro up to 0·5 mm. long ; *male glumes* similar but 3–4 mm. long, more coloured and midrib not so often excurrent. *Achene* quadrate-subglobose, obtusely trigonous, 1·5–1·75 mm. long, 1–1·1 mm. broad, more or less verrucose-lacunose or verrucose-trabeculate, pale to light fuscous or cinereous, shortly beaked.

Northern Rhodesia : Mwinilunga District ; Kalenda Plain, N. of Matonchi Farm, in shallow boggy soil overlying 'laterite' in open, 8 Dec. 1937, *Milne-Redhead* 3551 (K) ; ibid., Kalenda Dambo, in moist peaty shallow soil overlying 'laterite', 14 Feb. 1938, *Milne-Redhead* 4568 (K).

Angola : District of Moxico, W. of Kaperu (Kapeu) in moist 'lateritic' gravel, 10 Jan. 1938, *Milne-Redhead* 4036 (K).

These are splendidly collected specimens but unfortunately mostly not quite fully developed.

12. **Scleria poaeoides** *Ridley* in Trans. Linn. Soc., ser. 2, Bot. 2 : 170 (1884) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 502 (1902), in part. —Angola, *Welwitsch* 7142.

Scleria multispiculata Boeck., Cyper. Nov. 1 : 36 (1888) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 501 (1902), in part ; Hutch. & Dalz., Fl. W.Trop. Afr. 2 : 493 (1936) ; Piérart in Lejeunia, Mém. 13 : 32 (1953). —Nyasaland, *Buchanan* 1.

A tall, slender, mostly glabrous perennial with a slender rhizome from which the stems arise singly or in tufts and with a much branched slender inflorescence. *Rhizome* curved-horizontally or obliquely creeping, 0·75–2 mm. thick, dull reddish, clothed at first with reddish sheathing scales. *Stems* 25–65 cm. tall, 0·5–1 mm. thick, glabrous throughout, including the rhachis. *Leaves* 1–2 mm. wide, apices ending in a firm tip, lowest reduced to shortly bladed sheaths, often somewhat curved, thick, usually conduplicate or otherwise folded, sometimes plicate, glabrous ; *sheaths* reddish, especially the basal ones, nodes often blackish-red, upper glabrous, lower rather shortly pubescent, either in a line down the membranous front, or often on the back, mouth membranous, truncate or shallowly concave. *Inflorescence* with a main axis 3 13 cm. long, composed of 7–15 sessile glomerules of 1–3, usually 1, spikelets and from the lower 4–10 glomerules arise glomerate-spicate branches, each bearing 1–8 glomerules (often again branched) similar to those on the main axis, but rather less frequently reduced to one spike, upper glomerules on the main axis and branches, from subcontiguous up to 1 cm. apart on the axis, lower up to 1·5 cm. distant from one another, erect, 1–5 mm. broad ; *spikelets* 3·5 5 mm. long. *Bracteoles* glumiform with a short or rather short awn, much shorter than the glomerule or spikelet and inconspicuous. *Female glumes* 1·5 2 mm. long, sometimes minutely whitish adpressed hispidulous, very dark reddish-brown or blackish-red, mucronate ; *male glumes* 2·5–3·3 mm. long, glabrous, dark reddish-brown, muticous or mucronate. *Achene* subglobose, sometimes ovoid-globose, obtusely or obscurely trigonous, 1·2–1·4 mm. long, 0·9–1 mm. broad, white or slightly cinereous, tubercled, many of the tubercles transversely elongated-undulate, the surface becoming trabeculate, extremely shortly beaked.

French Guinea : Pita and environs, in wet ground, Sept. 1909, *Pobéguin* 2274 (P).

Sierra Leone : Kanya, 450 m., 7 Oct. 1914, *N. W. Thomas* 2967 (K).

Nigeria : Northern Province : Nupe swamp near Lom, *Barter* 1349 (K) ; Naraguta, Aug. 1930, *Lely* 446 (K) ; Pankshin Division : Plateau Province, Vodni, 1932, *Saunders* 48 (K).

Ubangi-Shari : Haute-Kotto, marsh of the Doungou, 14 Aug. 1922, *Le Testu* 4119 (P) ; Bozoum, marsh, 22 Aug. 1932, *Tisserant* 3143 (P).

Belgian Congo : between Faradje and Aru (Kibali-Ituri), 1000–1100 m., spring in the savannah, Aug. 1931, *Lebrun* 3506 (BR).

Tanganyika : Iringa Province ; Msima Stock Farm, 1932, *Emson* 335 (EA, K) ; Buha District ; Muhorro to Birara, brook with wet slopes, 1450–1385 m., *Peter* 37727 (det. Peter, cft. Kükenthal : not seen by me).

Nyasaland : Shire Highlands, *Buchanan* 1 (K) ; ibid., *Buchanan* (E).

Southern Rhodesia : Salisbury District ; Salisbury, in swamp water, 1440 m., 19 Feb. 1927, *Eyles* 4732 (K) ; ibid., 3 April 1927, *Eyles* 4869 (K) ; ibid., 1440 m., 29 Nov. 1931, *Brain* 7238 (K). Marandellas District, Marandellas, rare in vlei land, 19 Jan. 1949, *Fisher & Schweickerdt* 461 (K) ; grasslands, wet vlei 1500 m., 14 Nov. 1948, *Corby* 216 (Gov. Herb. No. 24868) (K) ; ibid., 3 Dec. 1948, *Corby* 278 (G. H. No. 24882) (K) ; ibid., 28 Dec. 1948, *Corby* 310 (G. H. No. 24891) (K).

Angola : Pungo Andongo ; between Caghuy and Sansamanda, with *Isoetes aequinoctialis*, April 1857, *Welwitsch* 7124, in part (LISU) : Huilla ; plentiful in sandy-spongy places at Quilebe near Huilla, in flower and fruit end of Nov. 1859, smells like lemon when rubbed, *Welwitsch* 7142 (BM, COI, K, LISU).

The Nigerian plants bear achenes which are less prominently sculptured than those from the other areas, and which are ovoid-globose rather than subglobose, but these differences are really not more than slight. The single specimen from Sierra Leone is not fruiting.

A remarkable grass-like sedge in general appearance and with its still more remarkable ally, *S. prophyllata* Nelmes, forming a distinct pair.

13. **Scleria prophyllata** *Nelmes*, sp. nov. ; affinis *S. poaeoides* Ridley sed inflorescentia ter ramosa prophyllo neque spicula in axilla rami cujusque praedita.—Angola, *Milne-Redhead* 3995.

A tall, slender, mostly glabrous perennial with a slender rhizome and with an extremely branched slender inflorescence. *Rhizome* obliquely creeping, 0·75–1·5 mm. thick, reddish, clothed at first with reddish sheathing scales. *Stems* 45–60 cm. tall, 0·75 mm. thick, glabrous throughout, including the rhachis. *Leaves* 1–2 mm. wide, apices ending in a firm tip, lowest reduced to shortly bladed sheaths, thick, usually conduplicate or otherwise folded, sometimes plicate, glabrous ; *sheaths* reddish, especially the basal ones, nodes often blackish-red, upper glabrous, lower rather shortly pubescent, either in a line down the membranous front, or often on the back, mouth membranous, truncate or shallowly concave. *Inflorescence* a thrice branched panicle, the ultimate axes being pedicels on the apices of which are borne the spikelets in ones, twos or threes, with a cladoprophyll only and no vestige of a spikelet produced in the axils of all the branches, the whole 5–8 cm. long, loose, branches spreading, straight or slightly cernuous ; *spikelets* 3·5 4 mm. long. *Bracteoles* apparently 0. *Female glumes* 1·5–2 mm. long, sometimes minutely whitish adpressed-hispidulous above, very dark reddish-brown, muticous or mucronulate ; *male glumes* 2·75–3 mm. long, sometimes minutely whitish adpressed-hispidulous above, very dark reddish-brown, apices mostly muticous. *Achene* (immature) probably to become subglobose, obtusely trigonous, up to 1·5 mm. long, pale, strongly tubercled-trabeculate, shortly beaked. *Stigmas* 3.

Angola : District of Moxico ; Dambo by R. Mumbala, in boggy grassland, 8 Jan. 1938, *Milne-Redhead* 3995 (BM, K).

Still more grass-like than its close ally, *S. poaeoides* Ridley, *S. prophyllata* is otherwise most remarkable. All other members of Sect. *Hypoporum* with branched inflorescences have one or more spikelets in all the axils of the branches, but in *S. prophyllata* there are no axillary spikelets. They have in every axil been replaced by a prophyll. The spikelets are thus not axillary and sessile but terminal and pedicelled.

14. **Scleria glabra** *Boeck.*, Cyper. Nov. 1 : 35 (1888) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 497 (1902) ; Piérart in Lejeunia, Mém. 13 : 22, t. 4, figs. 3–8 (1953).—Nyasaland, *Buchanan* 2.

A tall and medium-sized quite glabrous annual with loosely tufted stems, no rhizome, and a loose blackish branched inflorescence. *Stems* 60–110 cm. tall, probably about 1–2·5 mm. thick but much hidden in sheaths, glabrous including the rhachis. *Leaves* 2–6 mm. wide, flat to plicate-revolute or more or less folded, glabrous, lower reduced to not or scarcely bladed sheaths ; *sheaths* glabrous, mouth of sheath slightly produced into a very shortly membranous truncate-convex or convex tongue. *Inflorescence* with its main axis 7–26 cm. long, bearing 6–17 glomerules, each of 1–6 sessile clustered spikelets, and from many of the lower glomerules arise glomerate-spicate branches, each bearing 1–7 glomerules (often again branched) similar to those on the main axis, the upper glomerules subcontiguous to 1–3 times their length apart, the lower ones more distant, up to 3 or 4 cm. apart, erect, 1–6 mm. broad ; *spikelets* 3·5–5 mm. long. *Bracteoles* glumiform and pale with a short to long, smooth to minutely scaberulous awn, shorter than to about as long as the glomerules, inconspicuous. *Female glumes* 2·5–3 mm. long, mostly blackish-red with a conspicuous and broadish green midrib which is usually muticous but sometimes excurrent up to 0·5 mm. long ; *male glumes* similar but 3·25–4·25 mm. long, sometimes paler below or at the base. *Achene* subglobose but apex and base often subtruncate, obtusely trigonous, 1·5–1·8 mm. long, 1·2–1·5 mm. broad, lacunose, or tuberculate-trabeculate, sometimes with 3 smooth longitudinal areas between the angles (on the sides), whitish, ground colour becoming blackish, shortly beaked.

Belgian Congo : Katanga ; Tshinsenda, May 1914, *Rogers* 10788 (K) ; Urundi, Mosso-Ruyigi, grassy savannah, inundated during the rains and arid in the dry season, 16 Aug. 1951, *Michel & Reed* 170 (BR) ; ibid., Mosso, Kineiya, 6 June 1952, *Michel* 2498 (K, YBI).

Nyasaland : Shire Highlands, *Buchanan* 2 (E, K).

Northern Rhodesia : Mufulira, on drying dambo, 8 May 1934, *Eyles* 8338 (BR, K).

The following gathering, lacking its basal parts, apparently differs from the above-cited specimens of *S. glabra* only in its larger glomerules composed of more numerous spikelets :—

Northern Rhodesia : Abercorn District ; Kali Dambo, near Kawembi Mission, in wet marsh, peaty soil, 1530 m., 6 May 1952, *Mrs. H. M. Richards* 1678 (K).

A completely glabrous species.

15. **Scleria hispidior** (*C. B. Clarke*) *Nelmes*, stat. nov.

Scleria hispidula Hochst. ex A. Rich. var. *hispidior* C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 497 (1902).—Ethiopia, *Schimper* 1278.

A slender, rather short, hairy annual with tufted stems, 10–29 cm. tall, including a spicate inflorescence. *Stems* 0·6–0·8 mm. thick, glabrescent to densely villous below, sparsely to densely villous above. *Leaves* 1–2·25 mm. wide, mostly flat or flattish, usually subdensely villous, lower reduced to nearly bladeless sheaths ; *sheaths* mostly subdensely villous, mouth of sheath truncate concave, not with concentrated villosity. *Inflorescence* 3–7 cm. long, glomerules 3–7, each consisting of about 2–6 rather crowded spikelets, sessile, one or more sometimes having some of

its spikelets on a peduncle up to 1·5 cm. long, erect or suberect, 2–7·5 mm. broad ; *spikelets* 3–6 mm. long. *Bracteoles* glumiform with a long awn, surface blackish and mostly densely blackish hirsute, awn blackish ciliate, the whole bracteole not distinguishable from the lowest glume of each spikelet, which itself may be a bracteole, and not longer than the glomerule. *Female glumes* 2·5–3 mm. long, sparsely to densely covered with long blackish bristle like hairs, almost wholly blackish or blackish-red or with pale patches, midrib excurrent in a smooth to setulose awn 0·25–1 mm. or more long ; *male glumes* 2·5–3·5 mm. long, with blackish hairs in places, but pale areas more frequent and larger than in female glumes, usually mucronate, up to 0·25 mm. long. *Achene* trigonous-globose, 1·2–1·4 mm. long, 0·8–1 mm. broad, light reddish rugose-trabeculate to muricate on a paler ground, shortly beaked.

Ethiopia : Shireh (Chiré) Province, grassy meadows, margins of the river Taccari, Aug. 1840, *Quartin-Dillon et Pettit* (K) ; Tigrè to Begemeder, Dewr-Ari, swampy meadows, 2400 m., 5 Oct. 1863, *Schimper* 1278 (BM, K) ; Begemeder, mountains near Senka Berr, on the river Reb, 2040 m., 1863–68, *Schimper* 1266, *pro minor parte* (K) ; Dangila, 40 miles S. of Lake Tana, 2010 m., 17 Sept. 1926, *Cheeseman* 6328 (BM).

Uganda : Sipi, Bugishu, swampy pools on rocks, subdominant, 1800 m., 31 Aug. 1932, *Thomas* 442 (K) ; Eastern Province ; Mbale District, Sebei County, close to Kabururoni to Bukwa Road, 6 miles E.S.E. of Kabururoni, N. slopes of Mt. Elgon, wet patches in very short grassland, 1875 m., 12 Oct. 1952, *G. H. S. Wood* 448 (EA).

16. **Scleria hispidula** *Hochst. ex A. Rich.*, Tent. Fl. Abyss. 2 : 511 (1851) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 497 (1902).—Ethiopia, *Schimper* 1277.

A slender, almost glabrous to sparsely villous annual with tufted stems, 12–35 cm. tall, including a spicate inflorescence. *Stems* 0·5–1 mm. thick, glabrous and smooth except the angles on the upper part of the rhachis which are sometimes scaberulous. *Leaves* 1–2·5 mm. wide, flat to more or less revolute or plicate, glabrous or sparsely villous, lower reduced to dull reddish or vinaceous bladeless sheaths ; *sheaths* glabrous or sparsely villous, mouth of sheath more or less truncate, densely villous. *Inflorescence* 3–10 cm. long, the glomerules, each consisting of 2–6 crowded spikelets, sessile or sometimes up to half the glomerules having some of their spikelets at the apex of a peduncle up to 1 cm. long, 5–10, erect or suberect, 2·5–8 mm. broad ; *spikelets* 3–4 mm. long. *Bracteoles* linear and green, representing the excurrent midrib from a glumiform base, sometimes whitish ciliate below, reddish spinulose-ciliate above and sometimes below, from shorter than to (frequently) twice as long as their glomerules, suberect to much curved. *Female glumes* 2–2·5 mm. long, glabrous except that often there are a few bristle-like hairs on the midrib above, blackish red except for a wide greenish central stripe, midrib excurrent in a sparsely blackish spinulose-ciliate awn, 0·5–1 mm. long ; *male glumes* similar but 2–3 mm. long, more often with a glabrous midrib, and more completely blackish-red, mucro or awn 0–1 mm. long. *Achene* trigonous-spherical, much flattened at base and especially at apex, 1·4–1·5 mm. long, 1·4–1·5 mm. broad, raised tessellate, whitish, glabrous, rather shortly beaked.

Eritrea : Sarae, Adi Ugri, 1900 m., 12 Oct. 1903, *Pappi* 31 (EA).

Ethiopia : Gafta, 12 Sept. 1838, *Schimper* 1277 (BM, K) ; " Envoi de M. *W. Schimper*, 1853 ", no. 538 (K) ; Begemeder, mountains near Senka Berr, on the River Reb, 2040 m., 1863, *Schimper* 1266 *pro major parte* (BM, K).

Tanganyika : Moshi District ; Mpololo, 1050 m., Aug. 1928, *Haarer* 1525 (EA, K).

17. **Scleria erythrorrhiza** *Ridley* in Trans. Linn. Soc., Ser. 2, Bot. 2 : 167 (1884) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 499 (1902).—Angola, *Welwitsch* 7136.

A tall, medium sized, 3–5 mm. thick rhizomatous, hairy perennial. Stems 35–65 cm. tall, 1–2 mm. thick, glabrous to sparsely villous, scaberulous on the upper part of the rhachis, arising singly or few near together from the woody rhizome which, like the base of the stems is clothed with vinaceous sheaths or sheathing scales. *Leaves* 2–4 mm. wide, flattish-plicate to strongly revolute, thick and rough to the touch, sparsely to densely hirsute, lower bladeless or nearly so ; *sheaths* more or less hirsute, mouth of sheath produced into a long acuminate tongue. *Inflorescence* 4–11 cm. long, the glomerules each consisting of about 3–6 spikelets, upper glomerules about their own length distant from one another or subcontiguous, lower rather more longly spaced, 6–9, sessile, erect or suberect, 3–11 mm. broad ; *spikelets* 5–6 mm. long, excluding the longer awns. *Bracteoles* linear-trigonous, in the form of stout and very long awns, greenish brown, from a glumiform base, smooth or minutely scaberulous on the margins, from slightly exceeding to twice the length of their glomerules, lowest often up to 3–3·5 cm. long, straight or slightly curved. *Flowering glumes* 3–5 mm. long, pale greenish below, streaked or splashed reddish or reddish-brown above, densely whitish ciliolate-villous above and on the lower part of the long awn, which is pale greenish below and blackish-red above, and 2–4 mm. long, straight to curved. *Achene* oblong-ovoid, obscurely trigonous, about 2 mm. long, 1·2–1·3 mm. broad, shining whitish, scarcely beaked.

Belgian Congo : Manika Plateau, south of Kolwezi, sandy, not wooded, one plant seen, Aug. 1950, *Schmitz* 4127 (BR).

Tanganyika : Iringa District ; in a river-bed of the upper Ruhudje, Lupembe, north of the river, *Schlieben* 793 (det. Peter, cft. Kükenthal : not seen by me).

Northern Rhodesia : Mwinilunga District ; Sinkabolo Dambo, in moist grassland around grey termite mounds, 21 Dec. 1937, *Milne-Redhead* 3767 (K) ; North-East Rhodesia, *R. E. Fries* 900 (det. Peter, cft. Kükenthal : not seen by me).

Angola : Huilla ; sporadic in wooded meadows near the base of Morro de Ferrao da Sola, Jan. 1860, *Welwitsch* 7136 (BM, LISU) ; wet meadows on the banks of the river Campulua, Cuito-Cuito Cuanavale, Bie, 26 Feb. 1906, *Gossweiler* 2792, in part (K).

18. **Scleria verdickii** *De Wild.* in Rev. Zool. Afr. 14 : Suppl. Bot. 26, fig. 8 (1926) ; De Wild. in Pl. Bequaert. 4 : 243, fig. 10 (1927) ; Piérart in Lejeunia, Mém. 13 : 31 (1951).—Belgian Congo, *Verdick* 398.

A tall and rather large, glabrous or hairy perennial with a creeping rhizome, slightly bulbous stem bases, and a more or less branched inflorescence. *Rhizome* about 2 mm. thick. *Stems* 85–120 cm. tall, about 2 mm. thick above the basal leaf sheaths, angles smooth below, sometimes scaberulous above and on the rhachis, sides glabrous or glabrate, and a slightly bulbous base. *Leaves* 5–10 mm. wide, flat or flattish, glabrous to densely villous ; *sheaths* glabrous or sparsely villous, mouth moderately to deeply concave. *Inflorescence* having lower glomerules produced into glomerate-spicate branches, the main axis 8–19 cm. long, composed of 8–10 sessile glomerules of few to rather numerous spikelets, erect to obliquely spreading, branches up to 4 cm. long, bearing up to 4 glomerules similar to those on the main axis, upper glomerules and usually those on the branches contiguous or subcontiguous, lower more

spaced, lowest up to 5 cm. distant from one another, erect, 9–12 mm. broad ; *spikelets* 4–5 mm. long (excluding long awns). *Bracteoles* glumiform with a very long smooth or minutely scaberulous awn from as long as to considerably longer than the glomerule and straight or curved. *Female glumes* 2–2·75 mm. long, glabrous, castaneous or pale with wide castaneous streaks, midrib light greenish, excurrent in a minutely scaberulous strongly recurved awn 3–3·5 mm. long ; *male glumes* about 4 mm. long, glabrous, wholly reddish-castaneous, awn 1 2 mm. long, straight or slightly recurved. *Achene* ellipsoid or oblong-ellipsoid to subglobose, obtusely trigonous, 1·5–1·9 mm. long, 1–1·2 mm. broad, smooth and pearly white, shortly beaked.

Belgian Congo : Haut Katanga ; Lukafu, March 1900, *Verdick* 398 (BR) ; ibid, Upemba National Park, Kannya, valley of the river Lubango, 750 m., 22 Feb. 1949, *de Witte* 5606 (BR).

19. **Scleria bulbifera** *Hochst. ex A. Rich.*, Tent. Fl. Abyss. 2 : 510 (1851) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 500 (1902) et Illustr. Cyper. t. CXXII, fig. 56 (1909) ; Kükenth. in Fedde, Repert. Beih. XL, 1 : 530 (1938) ; Piérart in Lejeunia, Mém. 13 : 24, t. 1, fig. 9 (1953).—Ethiopia, *Schimper* 1557.

Scleria schweinfurthiana Boeck. in Flora, 62 : 570 (1879) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 500 (1902) ; Hutch. et Dalz., Fl. W. Trop. Afr. 2 : 491 (1936).—Anglo-Egyptian Sudan, *Schweinfurth* 2193.

Scleria bulbosa [sic] Hochst. ex A. Rich. var. *pallidiflora* Ridley in Trans. Linn. Soc., ser. 2, Bot. 2 : 167 (1884, April).—Angola, *Welwitsch* 7133.

Scleria mechowiana Boeck. in Engl. Bot. Jahrb. 5 : 510 (1884, Sept.) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 498 (1902).—Angola, *Mechow* 345.

Scleria buchananii Boeck., Cyper. Nov. 1 : 33 (1888) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 499 (1902).—Nyasaland, *Buchanan* 32.

Scleria buchananii var. *latifolia* De Wild., Contrib. Fl. Kat. 20 (1919).—Belgian Congo, *Homblé* 55.

Scleria schliebenii R. Gross in Notizbl. Bot. Gart. Berl. 101 : 657 (1932).—Tanganyika, *Schlieben* 484.

Scleria buchananii var. *typica* R. Gross in Notizbl. Bot. Gart. Berl. 101 : 658 (1932).—No type stated.

Scleria buchananii var. *laevinux* R. Gross, l.c. 658.—No type stated.

Scleria bulbifera var. *mechowiana* (Boeck.) Kükenth. in Fedde, Repert., Beih. XL, 1 : 530 (1938) ; Piérart in Lejeunia, Mém. 13 : 25 (1953).

Scleria bulbifera var. *hirsuta* Peter et Kükenth. in Fedde, Repert., Beih. XL, 1 : 531 (1938).—Nyasaland, *Cameron* 97.

Scleria thomasii Piérart in Bull. Soc. R. Bot. Belg. 83 : 405, fig. 1–4 (1951) et in Lejeunia, Mém. 13 : 27, t. 1, fig. 16–19 (1953).—Belgian Congo, *R. Thomas* 1202.

Scleria bulbifera var. *schweinfurthiana* (Boeck.) Piérart in Lejeunia, Mém. 13 : 26, t. 1, fig. 14–15 (1953).

Scleria bulbifera var. *latifolia* (De Wild.) Piérart in Lejeunia, Mém. 13 : 26 (1953).

A moderate-sized polymorphic perennial with stems bulbous at the base, a simple to slightly branched inflorescence and a creeping rhizome. *Rhizome* horizontal, internodes very short to long, 1–2 mm. thick. *Stems* 20–110 cm. tall, 0·5–2 mm. thick below, glabrous and smooth throughout or hairy above, including the rhachis, with scabrid angles, bulbous base ovoid, 10–15 mm. long, 3 ·10 mm. thick, reddish-fuscous. *Leaves* 1–5 (9) mm. wide, flat to more or less involute or revolute, glabrous to densely hirsute, lower reduced to almost bladeless sheaths ; *sheaths* usually more densely hirsute but varying to glabrous, apex of mouth in front concave or truncate (sometimes produced into a short tongue in large specimens), usually very densely hirsute. *Inflorescence* 2–20 cm. long, composed of 3–17 glomerules (excluding those on the sometimes occurring short branches), each consisting of 1 or 2 to a dozen or more sessile spikelets, usually not but sometimes from 1-several lower glomerules the axis is peduncled and bears 1-several glomerules, upper glomerules on the main axis from contiguous up to twice their own length distant, lower from once their own length to 4 cm. distant from one another, erect, 2–14 mm. broad ; *spikelets* 4–6·5 mm. long. *Bracteoles* longly aristate from a glumiform base, awn glabrous to scaberulous or longly ciliate, from about as long as to twice as long as the glomerules, straight to curved, lowest occasionally subfoliaceous, bracteoles and sometimes several empty glumes similar but smaller, glabrous or sometimes hairy. *Female glumes* 2–5 mm. long, glabrous except the midrib which is sometimes whitish ciliate above or throughout, from pale green with streaks and patches and a green midrib to wholly reddish-brown or blackish-red, midrib usually excurrent in a smooth and glabrous to scaberulous or whitish-ciliate awn 1–3 mm. long ; *male glumes* 3–5 mm. long, glabrous, usually wholly reddish-brown, but varying from castaneous to blackish-brown, usually not but sometimes midrib shortly excurrent. *Achene* obovoid, quadrate-obovoid to quadrate-globose or subglobose, obtusely to obscurely trigonous, 1·6–2 mm. long, 1·2–1·8 mm. broad, from smooth and shining through sparsely tuberculate and tuberculate-trabeculate to lacunose, white to dirty-white, shortly beaked.

A selection of specimens follows :

French Guinea : Macenta, on open rock hill, 600–750 m., fairly common, 14–15 Oct. 1947, *Baldwin* 9761 (K).

Sierra Leone : summit of Bintumane peak, wet meadow land and cliffs, 1 Nov. 1944, *Jaeger* 321 (K), 472 (K) ; swampy meadow at the summit of Bintumane peak, 17 Aug. 1945, *Jaeger* 1045 (K) ; N.E. face of Bintumane peak, swamp at 1620 m., 9 Jan. 1951, *Jones* 74 (K).

Ivory Coast : Haute Sassandra, Toura, near village of Gouékouma, 900 m., 24 May 1909, *Chevalier* 21668 (P).

Gold Coast : Northern Territories, near Yeji, common sedge in savannah forest, 120 m., July 1934, *Vigne* 3354 (K).

Togo : Tabalo massif, dry lateritic ground, 600 m., July 1933, *Mahoux* 2104 (P).

Nigeria : Northern Nigeria ; Kilba bush country, 30 July 1909, *Dalziel* 266 (K) ; Zaria prov. ; District Giwa, Guga Forest Reserve, about 15 miles from Zaria on the Sokoto road, in low regrowth of *Isoberlinia doka* savannah, 26 June 1950, *Keay* (FHI 25904) (K).

French Cameroons : near Buar, 6° N., 15° 35′ E., July 1914, *Mildbraed* 9789a (K).

Ubangi-Shari : Wadda, 26 June 1921, *Le Testu* 2892 (P).

Belgian Congo : Katanga ; Elizabethville, Feb. 1912, *Homblé* 55 (BR) ; ibid., Kundelungu Plateau, May 1923, *R. Thomas* 1202 (BR) ; Ituri, Gety, S.W. of Lake Albert, on hill slopes in poor soil, upland grasslands, 1500 m., 29 Aug. 1935, *H.B*

Johnston 1089 (K) ; Mukuen, 12 km. S.S.E. of Elizabethville, dry dembo on white sand, 14 Jan. 1948, *Schmitz* 242 (BR) ; Haut-Lomami, Koniama, 900 m., 22 Dec. 1948, *Mullenders* 1828 (BR, K) ; Ruzizi Plain, around Luberizi, savannah with *Loudetia*, 25 Feb. 1950, *Germain* 6302 (BR).

Anglo-Egyptian Sudan : Bahr el Ghazal Province, 27 Feb. 1869, *Schweinfurth* 2193 (K) ; Lado ; Yei River, common on all open ground, 1919, *Sillitoe* 23 (K).

Ethiopia : meadows in the upper northern region of the Scholoda mtns., 3 Oct. 1837, *Schimper* 1557 (BM, K) ; Begemeder, Senka Berr on the river Reb, 1863 68, *Schimper* 1277 (BM, K).

Uganda : Busana, 1050 m., April 1932, *Eggeling* 609 (K) ; Lango District ; Aduku, dampish places in savannah grass bush, June 1934, *H. B. Jonnston* 933 (K) ; Toro District ; Ruwenzori, Mobuku Valley, Bikoni, 1800 m., 29 Dec. 1934, along track through elephant grass. *G. Taylor* 2696 (BM) ; West Nile District ; Koboko, uncultivated grassland, May 1938, *Hazel* 584 (K) ; Karamoja District ; Napak, savannah forest, 1800 m., 27 May 1940, *Thomas* 3597 (EA, K) ; Nyakasura, near Fort Portal, 2100 m., June 1953, *E. M. Lind* 85 (EA).

Kenya : Trans Nzoia District ; 15 miles S. of Kitale, 1830 m., wooded grassland, common, *Combretum* savannah, 6 Aug. 1953, *Bogdan* 3781 (K).

Tanganyika : Lushoto District ; Eastern Usambaras, Monga, high meadows on Lutindi Mtn., 1080 m., 19 July 1917, *Peter* 21372 (EA) ; Njombe District ; river basin of the upper Ruhudji, Lupembe, near Likanga, N. of the river, 28 March 1931, *Schlieben* 484 (BR) ; Iringa District ; Mt. Tarik, 31 Jan. 1932, *Lynes* I.h. 63 (K) ; Mpwapwa District ; N. Mpwapwa. 1800 m., occasional on good soil, 6 March 1932, *Stables* 467 (EA, K) ; Ufipa District; near Mmemya Mtn., 1980 m., scattered among tufted grasses in open grassland, 13 Feb. 1951, *Bullock* 3683 (K).

Portuguese East Africa : Moramballa Mtn., Lower Shire, 600 m., 18 Jan. 1863, *Kirk* (K) ; Port Nyassa, 14 Feb. 1954, *Gomes e Sousa* 4197 (PRE).

Nyasaland : Shire Highlands, *Buchanan* 32 (K), 1272 (K) ; ibid., *Buchanan* (E) ; Mt. Zomba, 1200–1800 m., Dec. 1896, *Whyte* (K) ; Zomba, Namasi, Nov.–Dec. 1899, *Cameron* 97 (K) ; Nviki Plateau, Mynkowa, 1950 m., Feb.–March 1903, *McClounie* 2 (K) ; Chininjanje Valley, locally common, stony hill slopes, ± 1050 m., 14 Oct. 1941, *Greenway* 6281 (EA).

Southern Rhodesia : Wankie, Fuller Siding, 1000 m., Jan. 1928, *Wilkinson* 826 (K) ; near Salisbury, 9 Dec. 1936, *Eyles* 8837 (K) ; Mashonaland, Hartley, Norton, 28 m. W. of Salisbury, 24 Jan. 1946, *Weber* 165 (K) ; Chipinga District ; Chirinda Road, near Vuti, in woods, 1050 m. 18 Dec. 1947, *Whellan* 334 (Gov. Herb. No. 18480) (K ; Marandellas District ; Grasslands, dry land, 1500 m., 14 Nov. 1948, *Corby* 213 (Gov. Herb. No. 24858) (K).

Northern Rhodesia: Mwinilunga District ; just E. of Dobeka Bridge in *Cryptosepalum* woodland, 7 Dec. 1937, *Milne-Redhead* 3539 (K) ; ibid., just S. of Matonchi Farm in *Brachystegia* woodland, 12 Nov. 1937, *Milne-Redhead* 3216 (K) ; ibid., about 1 mile S. of Matonchi Farm, on sandy ground in *Brachystegia* woodland, 31 Dec. 1937, *Milne-Redhead* 3892 (K) ; Abercorn District ; escarpment above Chilongowelo, in very sandy soil in open among rough grass, 1500 m., 15 Dec. 1951, *Mrs. H. M. Richards* 71 (K) ; Mapanza W., dry bush, 1050 m., 28 Dec. 1953, *E. A. Robinson* 416 (K) ; Muckle Neuk, 12 miles N. of Choma, dambo, 1230 m., 13 Jan. 1954, *E. A. Robinson* 455 (K).

Angola : Pungo Andongo ; damp meadows of a peculiar kind, consisting only of very slender grasses, near Sobato de Muta-Lucala, but not seen elsewhere, March 1857, *Welwitsch* 7133 (BM, K, LISU) ; Baixa da Cassange, Dunda, near Lui River, 28 Jan. 1931, *Gossweiler* 9543 (K).

Transvaal : Hoogeveld, near Heidelberg, Nov. 1883, *Wilms* 1646 (K) ; Fountains, Pretoria, 7 Nov. 1922, *Moss* 7207 (K), 8343 (K) ; grassy slope above Fountains Valley, 23 Oct. 1929, *Cecil Sandwith* 196 (K).

Natal : Weenen cty., near Estcourt above new Formosa Stn., ± 1350 m., 2 Nov. 1944, *Acocks* 10758 (PRE) ; Pietermaritzburg ; Town Hill, ± 900 m. locally abundant among grasses near edge of stream, Nov. 1949, *Huntley* 567 (K, NAT) ; Bergville District ; Cathedral Peak Forest Res. Stn., 1860 m., fairly frequent in grassveld on kopje, 27 Oct. 1950, *Killick* 1063 (K, PRE).

Madagascar.

This is an extremely polymorphic species, but none of the epithets which I have placed as synonyms appears to represent a distinct taxon. There are comparatively large plants in the Sudan (*S. schweinfurthiana* Boeck.) and in Nyasaland (*S. buchananii* Boeck.) which pass through medium-sized specimens of Ethiopia (*S. bulbifora* Hochst. ex A. Rich.)

down to small ones from Rhodesia. The glumes are often very dark in plants from Ethiopia and Kenya, ferrugineous or castaneous in Rhodesia, and some are rather pale in Nyasaland. There is plenty of variation but all apparently of a phenotypic nature.

Piérart, in Lejeunia, Mém. No. 13, 24–27 (1953), has classified *S. bulbifera* into four varieties, three based primarily on achene-surface characters and one on leaf-sheath and accompanying " ligule " characters.

I do not propose to discuss the last-mentioned variant, var. *latifolia* (De Wild.) Piérart—except to remark that there seems a tendency in some species of *Scleria*, Sect. *Hypoporum* for the truncate mouth of the sheath (called a " ligule " by some authors) to elongate into a tongue.

Of more interest are Piérart's other three varieties : (1) *S. bulbifera* itself, (2) var. *mechowiana* (Boeck.) Kükenth., and (3) var. *schweinfurthiana* (Boeck.) Piérart, with lacunose, smooth, and tuberculate fruits respectively. I am unable to follow this classification because there are several gatherings of *S. bulbifera* in the Kew herbarium whose fruits have all three kinds of surface sculpture, and sometimes all are found on one and the same plant. Frequently one finds smooth and tubercled, or tubercled and lacunose, fruits on the same plant.

20. **Scleria dieterlenii** *Turrill* in Kew Bull. 1914 : 20 (1914).—Basutoland, *Dieterlen* 749.

A short and rather slender, sparsely to rather densely villous perennial with sometimes a very slender tuber-forming rhizome, and an unbranched inflorescence. *Rhizome* elongate, curved-descending, very slender (0·5–1 mm. thick), sometimes ending in a tuber which is about 1 cm. long and 3–4 mm. thick. *Stems* 15–45 cm. tall, 0·5–0·8 mm. thick, glabrous or very sparsely villous, scabro-ciliate on the rhachis. *Leaves* 1–2·5 mm. wide, flat or flattish or more or less folded, usually sparsely villous but varying from glabrous to subdensely villous, lower shortly bladed to bladeless and often reddish or vinaceous sheaths ; *sheaths* glabrous to villous, mouth truncate or concave and more or less villous. *Inflorescence* 2–8 cm. long, composed of 3–8 sessile glomerules, each consisting of about 1–8 sessile clustered spikelets, upper from crowded to spaced their own length apart, lower from subcontiguous to much more distant (up to 2 cm.) from one another, erect, 2–9 mm. broad. *Spikelets* 4–5 mm. long. *Bracteoles* strongly aristate from a villous glumiform base, awn more or less densely ciliate below and scabro-ciliate towards the apex, straight to curved or flexuous, shorter to a little longer than the glomerules, bract of the lowest glomerule longer, frequently subfoliaceous and up to 2·5–4 cm. long. *Female glumes* 2·5–3 mm. long, apex acute, sparsely to densely whitish villous, pale or light reddish with darker reddish streaks, midrib sometimes very shortly excurrent ; *male glumes* 4–4·5 mm. long, apex obtuse to rounded, lower whitish villous and light ferrugineous with darker streaks, upper glabrous and rich reddish, midrib not or sometimes slightly excurrent. *Achene* subglobose, sometimes obovoid-globose, distinctly but obtusely trigonous 1·3–1·8 mm. long, 1–1·25 mm. broad, whitish or cinereous, transversely light to bright reddish-brown trabeculate-verrucose, shortly beaked.

Northern Rhodesia : Abercorn District ; Sungu, 25 miles from Abercorn, in loamy damp meadow, short grass, 1530 m., 23 Feb. 1952, *Mrs. H. M. Richards* 805 (K) ; ibid., Abercorn, pans, 1500 m., 20 Jan. 1955, *Mrs. Richards* 4200 (K).

Angola : Huilla, in the deeply herb-grown woods of Monino, seen only in one place, end of Jan. 1860, *Welwitsch* 7137, in part (BM, LISU).

Basutoland : Léribé District ; Léribé Plateau, summer (December) [? year], *Dieterlen* 749 (Herb. Aust. Aft. 1877) (K).

The following specimen may belong here but it is not in good enough condition for one to be certain.

Natal : Van Reenen, wet places and along streams, Jan. 1919, *Bews* (Natal Univ. Herb. No. 471).

21. **Scleria suaveolens** *Nelmes*, sp. nov. ; affinis *S. pulchellae* Ridley sed culmis longioribus, glomerulis angustioribus, spiculis paucioribus, glumis femineis haud atrorubidis differt.—Northern Rhodesia, *Mrs. H. M. Richards* 847.

A rather short, very slender, glabrate or sparsely hairy annual with tufted stems and a branched inflorescence. *Stems* 18–25 cm. tall, 0·4–0·6 mm. thick, glabrous including the rhachis, or sometimes a few scattered hairs on this above. *Leaves* about 1 mm. wide, conduplicate, glabrous, lower reduced to shortly and scarcely bladed sheaths ; *sheaths* sparsely to very sparsely villous, upper sometimes glabrous, mouth more or less truncate, thinly membranous and easily rupturing. *Inflorescence* with a main axis 3–4 cm. long which gives rise to 1–2 longer and a similar number of shorter branches from its lower two-thirds or so, glomerules sessile and situated contiguously on the upper part of the main axis and on the branches, with spikelets single below but frequently in twos and threes towards the apices but these are more spaced (up to 1 cm.) on the lower branching part of the main axis, erect, 1–2 mm. broad ; *spikelets* 2·5–3·5 mm. long. *Bracteoles* glumiform, pale, with a long, sparsely whitish-ciliate awn, about equalling or slightly longer than the spikelets, cilia very long, sometimes on the upper part of the midrib if the glumiform base is long. *Lowest glumes* often extremely sparsely ciliolate ; *female glumes* 2–2·25 mm. long, glabrous, wholly pallid, or streaked dull reddish, with a greenish midrib which is excurrent in a mucro 0·25–0·5 mm. long ; *male glumes* 2 2·5 mm. long, sometimes mucronate, rather more reddish than the female glumes. *Achene* (not quite mature) more or less subglobose, obtusely trigonous, about 1 mm. long, about 0·8 mm. broad, lacunose-trabeculate to tubercled-trabeculate and whitish, except for 3 narrow smooth longitudinal inter-angular strips which become blackish, very shortly beaked.

Northern Rhodesia : Abercorn District ; pans near Abercorn, in damp peat, sweet smelling, rather like citronella, no smell when dried, 1500 m., 29 Feb. 1952, *Mrs. H. M. Richards* 847 (K).

22. **Scleria pulchella** *Ridley* in Trans. Linn. Soc., ser. 2, Bot. 2 : 168 (1884) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 495 (1902) ; Piérart in Lejeunia, Mém. 13 : 21, t. 1, fig. 3 (1953).—Angola, *Welwitsch* 7141.

A short, slender, nearly glabrous annual with tufted stems, 8–15 cm. tall, and a short spicate or slightly branched inflorescence. *Stems* 0·3–1 mm. thick, wholly glabrous, including often the rhachis. *Leaves* flattish to variously folded, 1–2 mm. wide when flattened out, glabrous or sparsely villous, lower with vinaceous sheaths, the lowest of which are

bladeless ; *sheaths* glabrous or occasionally sparsely villous, mouth of sheath more or less truncate or concave, glabrous. *Inflorescence* 1–4 cm. long, each glomerule consisting of several clustered spikelets, glomerules sessile, 3–10 on the main axis, but frequently from the lower 1–3 glomerule-axils are developed short secondary axes on which are borne 1–4 additional sessile glomerules, erect or suberect, 2–7 mm. broad ; *spikelets* 2–4 mm. long. *Bracteoles* glabrous, pale, and glumiform below, aristate and usually sparsely ciliate above, equalling or slightly exceeding their glomerules, sometimes slightly curved, lowest sometimes subfoliaceous and up to as long as or longer than the inflorescence. *Female glumes* 1·2–2·5 mm. long, glabrous, wholly blackish-red except for a widish well-defined greenish midrib, which is excurrent in a smooth mucro or awn, 0·3–1 mm. long ; *male glumes* very similar, 2·25–2·5 mm. long, sometimes mucronate, up to 1 mm. long, often wholly dark reddish brown or reddish black. *Achene* subglobose, flattened at base and apex, obtusely trigonous 0·9–1·3 mm. long, 0·8–1 mm. broad, whitish or light reddish-lacunose-trabeculate, sometimes with 3 longitudinal smooth areas, base colour white becoming fuscous, glabrous, scarcely or very shortly beaked.

Belgian Congo : Haut-Katanga ; Marungu Plateau, near Kasiki, temporary lake on lateritic slab, in dense masses, 25 April 1948, *Schmitz* 1580 (BR).

Tanganyika : Iringa District ; Lupembe, in river-beds on the upper Ruhudje, 1600 m., *Schlieben* 1037a (det. Peter, cft. Kükenthal : not seen by me).

Nyasaland : Shire Highlands ; *Buchanan* 19 (E, K), D (K) ; Zomba District : Zomba Plateau, gregarious on a sunny seepage slope, 1750 m., citronella scented, 31 May 1946, *Brass* 16108 (K).

Angola : Huilla ; with *Eriocaulon* and species of *Xyris* on the lofty short-grassed pastures of Empalanca, Dec. 1859, March and May 1860, *Welwitsch* 7141 (BM, K, LISU) ; River Pallance, March 1883, *Newton* 7 (BM).

Boeckeler in his Cyper. Nov. 1 : 34 (1888), misidentified Buchanan's Nyasaland plant as *S. hilsenbergii* Ridley, which is probably confined to Madagascar.

23. **Scleria remota** *Ridley* in Trans. Linn. Soc., ser. 2, Bot. 2 : 169 (1884) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 496 (1902).—Angola, *Welwitsch* 7129.

A tall, slender, tufted annual with villous sheaths and glabrous stems and glabrous to very sparsely villous leaves, and an unbranched nearly glabrous inflorescence. *Stems* 28–40 cm. tall, 0·75–1 mm. thick below, glabrous, usually including the rhachis. *Leaves* 1–2·25 mm. wide, flat to variously folded, glabrous to very sparsely villous, lower reduced ; upper *sheaths* glabrous to sparsely villous, lower sometimes subdensely so, mouth of sheath densely villous, truncate or very shallowly concave. *Inflorescence* 6–13 cm. long, composed of 7–11 sessile glomerules, each of 1–5 crowded clustered spikelets, upper about their own length apart, lower slightly more spaced or up to about 2 cm. apart, erect, 2–9 mm. broad ; *spikelets* 4–5 mm. long. *Bracteoles* pale or palish and glumiform and glabrate or glabrous below, longly and smoothly or minutely scaberulously aristate sometimes sparsely ciliolate above, mostly shorter but sometimes as long as the glomerules, inconspicuous. *Female glumes* 2·25–3 mm. long, glabrous, light green with streaks and large patches of reddish-brown, midrib light green, excurrent in a glabrous awn 1–1·25 mm. long ; *male glumes* 4·5–5 mm. long, wholly reddish-castaneous or sometimes pale below and light green on the midrib, muticous, other-

wise as the female glumes. *Achene* obovoid with a truncate apex or subglobose, distinctly but obtusely trigonous, 1·9 2 mm. long (excluding a long beak) and 1·5–1·7 mm. broad, whitish, lacunose or trabeculate-lacunose, and somewhat muricate, with irregular smooth areas on the three sides, longly beaked.

Angola : Pungo Andongo, in damp wooded meadows between Serra de Pedras de Guinga, and Candumba, March 1857, *Welwitsch* 7129 (BM, K, LISU).

The following gatherings are near *S. remota* but they appear to be perennial :

Angola : swamps near the banks of the river Neve, Humpata, common, in water, Feb. 1883, *Newton* 5 (COI) ; River Pallanca, wet ground, May 1883, *Newton* 4 (BM, COI).

24. **Scleria bicolor** *Nelmes*, nom. and stat. nov.—Angola, *Welwitsch* 7131.

Scleria remota Ridley var. *hispida* Ridley in Trans. Linn. Soc., ser. 2, Bot. 2 : 169 (1884).—Angola, *Welwitsch* 7131, 7131b, in part.

A tall, slender, tufted annual, wholly and mostly rather densely villous, with an unbranched inflorescence. *Stems* 23–42 cm. tall, 0·5–0·75 mm. thick below, more or less villous, including the rhachis. *Leaves* 1·5–3 mm. wide, flat, more or less villous, mostly horizontally-adpressed-villous from nerves, lower reduced ; *sheaths* villous, mostly in longitudinal lines, mouth of sheath sparsely villous, subtruncate or convex, i.e. produced into a short, rounded tongue. *Inflorescence* 6–15 cm. long, composed of 5–15 glomerules, each of these composed of 1–5 clustered spikelets, upper half twice their own length distant from one another, lower once their length to 2·5 cm. apart, erect, 1–9 mm. broad ; *spikelets* 5–6 mm. long. *Bracteoles* glumiform and villous below, aristate and ciliate and sometimes scaberulous above, mostly shorter than the glomerules. *Female glumes* 2–3 mm. long, nearly glabrous to more or less villous, always densely ciliate on the midrib, pale but streaked reddish-brown, midrib nearly always excurrent up to 1 mm. long ; *male glumes* 4–5·5 mm. long, more or less densely villous, not ciliate on the midrib, pale below, streaked or patched dark reddish-brown or blackish-red above, usually muticous, sometimes mucronulate. *Achene* (not mature), subglobose, obtusely trigonous, 1·25–1·5 mm. long, 1–1·25 mm. broad, whitish, becoming blackish, lacunose-trabeculate, shortly beaked.

Angola : Pungo Andongo ; plentiful but only in one locality in spongy rocky places near Catete, 28 Feb. 1857, *Welwitsch* 7130 (BM, COI, K, LISU) ; ibid., higher damp slopes of Funda-Quilombo in the praesidium, April 1857, *Welwitsch* 7131, in part (BM, K, LISU) ; ibid., growing among mosses with another scirpoid plant on the heights of Pedra Songue, April 1857, *Welwitsch* 7131b, in part (BM, LISU).

25. **Scleria ustulata** *Ridley* in Trans. Linn. Soc., ser. 2, Bot. 2 : 168 (1884) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 497 (1902).—Angola, *Welwitsch* 7134.

A slender, tufted, completely glabrous annual of medium height and an unbranched inflorescence. *Stems* 20–37 cm. tall, 0·5–0·75 mm. thick below, glabrous. *Leaves* 0·75–2 mm. wide, flat to more or less folded, glabrous ; *sheaths* glabrous, mouth of sheath membranous, truncate or slightly convex. *Inflorescence* 3–5 cm. long, composed of 6–12 glomerules, each of several crowded spikelets, all contiguous, forming a continuous

inflorescence or lower slightly separated, erect, 2–7 mm. broad ; *spikelets* 5–6 mm. long. *Bracteoles* glumiform, glabrous, acuminate, usually longly and smoothly aristate, from a little to considerably longer than the glomerules. *Female glumes* 3·5 4 mm. long, glabrous, pale reddish below, dark reddish-brown above, midrib excurrent in a smooth awn, 0·5–1 mm. long ; *male glumes* similar but usually 4 mm. long and often blackish-red above. *Achene* more or less globose, often slightly flattened at the base and apex, obtusely angled, 1·7 1·9 mm. long, 1·4–1·6 mm. broad, muricate-lacunose, or muricate-trabeculate, whitish at first becoming narrowly or broadly blackish on smooth longitudinal areas between the angles, glabrous, shortly beaked.

Angola : Pungo Andongo ; with *Drosera indica* in damp woods where *Andropogon* grows on the banks of the river Cuanza, 12 March 1857, *Welwitsch* 7134 (BM, K, LISU).

This species is closely related to *S. pergracilis* (Nees) Kunth and resembles still more closely the author's var. *brachystachys*, but the much larger glumes of *S. ustulata* together with other minor differences give this species a distinct facies.

26. **Scleria pergracilis** (*Nees*) *Kunth*, Enum. Pl. 2 : 354 (1837) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 495 (1902) ; C. B. Clarke, Illustr. Cyper. t. 121 (1909) ; Hutch. & Dalz., Fl. W. Trop. Afr. 2 : 491, 493 (1936) ; Piérart in Lejeunia, Mém. 13 : 20, t. 4, fig. 1, 2 (1953), var. *pergracilis*.

Hypoporum pergracile Nees in Edinb. New Phil. Journ. 17 : 267 (1834). —India, *Wallich* 3406.

Scleria pergracilis var. *major* Cherm. in Bull. Soc. Bot. France, 81 : 268 (1934).—Togo, *Mahoux* 2163.

A slender and almost completely glabrous annual with tufted stems and an unbranched inflorescence. *Stems* 20 95 cm. tall, 0·25–1 mm. thick, glabrous. *Leaves* 1–2 mm. wide, flattish or margins somewhat revolute, glabrous ; *sheaths* glabrous or sparsely pilose, inconspicuous, mouth of sheath concave or truncate. *Inflorescence* 5–13 cm. long, consisting of 5 30 small glomerules, each of 1–5 crowded spikelets, upper from subcontiguous to once or twice their own length apart, lower usually more distantly, usually about 1–1·5 cm., spaced apart, erect or suberect, 2–7 mm. broad ; *spikelets* 4–5 mm. long. *Bracteoles* glumiform, glabrous, about as long as to a little longer than the glomerules, longly acuminate above, but midrib not or scarcely excurrent. *Female glumes* 2·5–3·25 mm. long, glabrous, pale or light reddish with reddish-brown streaks below, more or less blackish-red above, midrib not or scarcely excurrent ; *male glumes* very similar but more suffused with reddish-brown to blackish-red, smaller on the average. *Achene* more or less globose but somewhat flattened at bottom and top, obtusely angled, 1·4–1·6 mm. long, 1·2–1·6 mm. broad, tessellate-lacunose, muricate-lacunose, or trabeculate-lacunose, except sometimes for narrow smooth longitudinal areas between the angles (on the 3 mid-faces), wholly whitish or ground colour becoming blackish. glabrous, shortly beaked.

French Sudan : Kita massif, " prairie humide ", 25 Oct. 1943, *Jaeger* 53 (K).

Togo : Sokodé, on the way to Atakpamé, very marshy ground, Aug. 1933, *Mahoux* 2163 (P).

Dahomey : Dassa Zoumé, marsh, July 1912, *Annet* 153 (P).

Nigeria : Lagos ; very common on rocks, *Macgregor* 243 (K) ; Nupe, in swamps, *Barter* 1006 (K) ; Northern Nigeria ; Zaria District, " comm. XII-1930 ", *Taylor* 36 (EA, K).

Ubangi-Shari : river Baédou, 27 km. south of Ippy, marsh, 17 Sept. 1925, *Tisserant* 2010 (P) ; N.-E. Bozoum, on rocks, very wet place, 3 Dec. 1933, *Tisserant* 3382 (P).

French Cameroons : Tuburi Marsh, 3 Nov. 1910, *Miss O. Macleod* (BM).

French Congo : Ogoguè, savannah, Feb. 1887, *Thollon* 734 (P).

Anglo-Egyptian Sudan : Equatoria Province ; Bahr el Ghazal, Agada, 12 Oct. 1869, *Schweinfurth* 2472 (K).

India, Ceylon, New Guinea.

var. **brachystachys** *Nelmes*, var. nov. ; a typo inflorescentiis brevioribus crassioribus, bracteis longioribus differt.—Southern Rhodesia, *Brain* 3710.

Stems 15–36 cm. tall. *Inflorescence* 2–6 cm. long, consisting of about 6–18 glomerules, each composed of 1–7 crowded spikelets, upper contiguous or only slightly separated, lower subcontiguous to about their own length apart, about 2–9 mm. broad. *Bracts* longer to much longer than the glomerules, longly acuminate to attenuate, midrib sometimes excurrent in a short to long and smooth or slightly scaberulous awn.

Tanganyika : Uyansi ; W. towards Tura, in ponds, 1250–1230 m., *Peter* 34243, 34255 (not seen by me, det. Peter, cft. Kükenthal) ; S. Highlands Province ; in dried up swamp with *Aristida* 210a, 1440 m., rec. 20 Sept. 1948, *Childs* 210b (EA).

Southern Rhodesia : Salisbury District ; 1440 m., 25 April 1931, *Brain* 3710 (K) ; Hartley District ; Poole Farm, common in a dense community, with *Pycreus sulcinux*, *Fimbristylis exilis*, *Ascolepis protea*, on slope only just dry after 5 week's drought, 1200 m., 11 March 1951, *Hornby* 3234 (G. H. No. 32910) (K).

Natal : Dundee District ; near Waschbank, sour sand veld, common in patches, strongly scented, ± 1050 m., 30 March 1944, *Pentz & Acocks* 10277 (PRE).

27. **Scleria glomerulata** *Oliver* in Trans. Linn. Soc. 29 : 170, t. 110B (1875) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 496 (1902) ; Piérart in Lejeunia, Mém. 13 : 19, t. 1, fig. 1 (1953).—Uganda, *Speke & Grant* 668.

A rather short and slender, sparsely hairy annual, with strongly tufted stems and an unbranched inflorescence. *Stems* 8–20 cm. tall, 0·5–1 mm. thick, glabrous below, sparsely villous on the rhachis. *Leaves* 1–3 mm. wide, flat or flattish, glabrous or sparsely villous, lower with vinaceous sheaths the lowest of which are bladeless ; *sheaths* glabrous or sparsely villous, mouth of sheath more or less truncate, often hirsute. *Inflorescence* 3–7 cm. long, the glomerules consisting of several clustered spikelets, sessile, 3–4, erect to suberect, 5–10 mm. broad ; *spikelets* 4–6 mm. long. *Bracteoles* aristate or subherbaceous from a glumiform base, glabrous or sparsely ciliate, from about as long as to twice or more the length of their glomerules, sometimes curved. *Lower empty glumes* ciliate on midrib and awn. *Female glumes* 3–3·75 mm. long, glabrous except strongly ciliate on at least the upper part or nearly the whole of the midrib, wholly pale or with reddish streaks, midrib excurrent in a usually strongly ciliate mucro or awn 0·5–1 mm. long ; *male glumes* 3·5—4 mm. long, usually wholly glabrous, usually wholly light-reddish, midrib not or not usually excurrent. *Achene* obovoid to quadrate-subglobose, obtusely trigonous, about 2 mm. long and about 1·5 mm. broad, transversely rugose-lacunose or undulate-trabeculate, white, glabrous, very shortly beaked.

Uganda : Madi, in tufts among rock debris or crevices, 4° N., 32° E., whole plant sweetly scented, Dec. 1862, *Speke & Grant* 668 (K).

28. **Scleria tricholepis** *Nelmes*, sp. nov.; affinis *S. pinetorum* Britton sed achaeniis minoribus plerumque oblongo-obovoideis et undulato-trabeculatis praecipue differt.—Sierra Leone, *Jones* 194.

Scleria melanotricha var. *glabrior* C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 496 (1902).—Sierra Leone, *Scott Elliot* 4187.

Scleria schweinfurthiana var. *melanocarpa* Cherm. in Arch. Bot. Caen. IV, Mém. 7 : 46 (1931).—Ubangi-Shari, *Tisserant* 2066.

A glabrescent to villous and rather slender annual of varying height, with tufted stems and an unbranched inflorescence. *Stems* 10–55 cm. tall, 0·3–1 mm. thick, glabrous to villous. *Leaves* 1–3 mm. wide, usually flat or flattish, sometimes revolute-plicate or somewhat folded, glabrescent to villous, lower shorter and lowest reduced to almost bladeless vinaceous sheaths ; *sheaths* glabrescent or sometimes villous, especially at the more or less truncate mouth. *Inflorescence* 3–13 cm. long, glomerules 4–15, all clearly spaced, upper 0·75–2 cm., lower 1–2·25 cm., apart from one another, sessile, erect or suberect, 3–7 mm. broad, each composed of 3–6 *spikelets*, which are 3–4 mm. long. *Bracteoles* shortly pale to reddish glumiform at the base, longly or very longly aristate and whitish ciliate above, often about as long as but frequently longer than, sometimes up to twice as long as, the glomerules, straight to curved. *Lower empty glumes* ciliate on midrib and awn. *Female glumes* 2–3 mm. long, sparsely to densely ciliate on the awn and more or less down the midrib, otherwise glabrous, wholly pale greenish or streaked and patched reddish to wholly bright reddish or blackish red, midrib excurrent in an awn 0·5–1 mm. long ; *male glumes* 2·25–4 mm. long, often bright reddish, mucro up to 0·25 mm. long, otherwise as female glumes. *Achene* usually oblong-obovoid but sometimes oblong-globose, obtusely but distinctly trigonous, 1·25–1·6 mm. long, 1·1–1·3 mm. broad, undulate-trabeculate, less often lacunose-trabeculate, pale, whitish, or cinereous, sometimes becoming darker, shortly or very shortly beaked.

French Guinea : Timbo, Oct. 1907, Pobéguin 1790a (K, P) ; Macenta, 600–750 m., on open rock hill, fairly common, 14–15 Oct. 1947, *Baldwin* 9791 (K).

French Sudan : Koulikoro, 6–14 Oct. 1899, *Chevalier* 2471 (BR) ; Kita massif—summit plateau–lake, 27 Sept. 1943, *Jaeger* 50 (K).

Sierra Leone : 1792–94, *Afzelius* (BM) ; *Morson* (K) ; near Regent, dry open bare path on augite, 8–12 Dec. 1891, *Scott Elliot* 4187 (K) ; Brookfields, ' Foni flats', 12 Oct. 1926, *Deighton* 2141 (K) ; Hill Station, bush path, 19 Oct. 1926, *Deighton* 243 (K) ; near Port Loko (Maforki), among short grass in wet place on laterite rock, 24 Oct. 1951, *Jordan* 635 (K) ; Sugar Loaf Mtn., 420 m., on wet rock outcrop in shallow running water, common, 1 Nov. 1951, *Deighton* 5614 (K) ; Picket Hill, 690 m., on wet rock face, 18 Nov. 1951, *Jones* 187 (K) ; ibid., on rock outcrop, 18 Nov. 1951, *Jones* 194 (K) ; Brookfields, Colony, in wet places on laterite flats, 1952, *Jordan* 783 (K).

Liberia : Montserrado Co. ; Duport, wet slightly brackish, sandy soil, 15 Nov. 1926, *Linder* 1453 (K) ; savannah east of Monrovia, 31 Aug. 1947, *Baldwin* 9204 (K) ; Kolahun District ; on rock outcrop near Genne-Loffa, 2 Nov. 1947, *Baldwin* 10089 (K) and *Baldwin* 10101 (K) ; Bopors District ; rock outcrop near Tawata, 15 Nov. 1947, *Baldwin* 10344 (K) ; Grand Bassa Co. ; Grand Bassa, *Dinklage* 2300 (not seen by me) ; Gbarnga District, rock outcrop, 3 miles E. of Palilah, 20 Aug. 1947, *Baldwin* 9152 (K).

Ubangi-Shari : Haut-Oubangui ; between Lati and Kono, 23 Oct. 1902, *Chevalier* 5837 (K, P) ; Bangui ; Dunn, 15 km. N.E. of Sainte Famille, wet plateau, roots omitting an agreeable odour when fresh, Sept. 1914, *Tisserant* 83 (P) ; 20 km. W. of Yalinga, pond on laterite, 3 Sept. 1921, *Le Testu* 3211 (P) ; on gneiss rocks near Ngono, 20 km. N.E. of Bambari, 9 Oct. 1925, *Tisserant* 2066 (P) ; Oubangui, Waka region, 1 Feb. 1929, *Tisserant* 2362 (K) ; rocks S. of Bosoum, 7 Nov. 1937, *Tisserant* 3572 (P).

Belgian Congo : N. Uele ; Sangatia, Semio region, 1919, *Rodhain* in *Bequaert* (BR) ; Mt. Bangenze, at about 15 km. S. of Ango, on granite slabs, ± 700 m., Nov. 1945, *Germain* 4290 (BR, K).

KENYA : Kipkarren District ; near margins of rock pools, 1931, *Mrs. Broadhurst-Hill* 38 (EA, K).

In " Cyperaceae in Liberia " [by] Nelmes and Baldwin (Amer. Journ. Bot. 39 : 368 393 : 1952), on p. 391, the above cited Liberian numbers were placed under *S. pergracilis* (Nees) Kunth. Further study has convinced me that though they are very closely related to *S. pergracilis*, these Liberian plants, together with other chiefly West African specimens, are specifically distinct from it.

S. tricholepis is also very near to the Cuban species, *S. pinetorum* Britton, but the surface characters of the fruits separate them specifically.

29. **Scleria spondylogona** *Nelmes*, sp. nov. ; affinis *S. delicatulae* Nelmes sed spiculis brevioribus glumis masculis immaculatis brevioribus, achaeniis oblongo-ellipsoideis vel oblongo-obovoideis praecipue differt.—Northern Rhodesia, *Bullock* 2871.

A very slender, nearly glabrous annual, with loosely tufted stems and a slender inflorescence. *Stems* 12–35 cm. tall, 0·2–0·8 mm. thick, glabrous. *Leaves* 0·3–1 mm. wide, flattish to subconduplicate, glabrous, yellow-green, lower often with vinaceous sheaths, the lowest of which are nearly bladeless ; *sheaths* glabrous or sparsely villous down the front, mouth truncate or slightly concave. *Inflorescence* 1–13 cm. long, glomerules 3–16, each composed of 1–6 spikelets, and contiguous to shortly spaced from one another, erect or suberect, 1–7 mm. broad ; *spikelets* 3–4 mm. long. *Bracteoles* glumiform below, tapering above into an acute apex, mucronate to aristate, awn sometimes sparsely hispidulous or ciliolate-hispidulous, from shorter to about as long as the glomerules, inconspicuous, straight or slightly curved, apex reddish-black. Small lower *empty glumes* light yellowish-green, blackish tipped. *Female glumes* 2–2·5 mm. long, apex subobtuse to rotund, yellowish-green to fulvous with a blackish-tipped apex, midrib muticous to excurrent up to 0·5 mm. long ; *male glumes* 2·5–3·25 mm. long, midrib not excurrent, otherwise similar to the female glumes. *Achene* oblong-ellipsoid or oblong-obovoid, obtusely but distinctly trigonous, the angles being translucent, becoming strongly raised above the surface, vertebrate in appearance, 1·1–1·3 mm. long, 0·8 0·9 mm. broad, tessellate or cancellate, reddish-vinaceous, very shortly beaked.

NORTHERN RHODESIA : Mwinilunga District ; Kalenda Dambo, dominant in places on moist peaty shallow soil overlying ' laterite ', 14 Feb. 1938, *Milne-Redhead* 4569 (K) ; Abercorn District ; banks of Lunzua River below the falls, near Kapata, + 750 m., among tall grasses in deep red soil, 18 April 1950, *Bullock* 2871 (K).

30. **Scleria delicatula** *Nelmes*, sp. nov. ; affinis *S. spondylogonae* Nelmes sed spiculis longioribus glumis masculis rubido-brunneis maculatis longioribus, achaeniis obovoideis praecipue differt.—Northern Rhodesia, *Mrs. H. M. Richards* 600.

An extremely slender, glabrous annual with densely tufted stems and an extremely slender inflorescence. *Stems* 20 35 em. tall, 0·2–0·5 mm. thick, apex usually subcernuous. *Leaves* about 1 mm. wide, thickened-conduplicate, lower with shorter blades and partly vinaceous sheaths ; *sheath* with mouth slightly concave. *Inflorescence* 2 9·5 cm. long, the glomerules, 4 15, each composed of 1 3 spikelets, and separated by 1–

several times their own length from one another, erect or suberect, 1–6 mm. broad ; *spikelets* 3–4·75 mm. long. *Bracteoles* light greenish glumiform below, lanceolate, usually aristate, awn sometimes ciliolate-hispidulous, shorter to about as long as the glomerules, straightish. Lower small *empty glumes* pale or light yellowish green. *Female glumes* 2–2·3 mm. long, apex obtuse to rotund, pale or light yellowish-green with a greenish midrib, sometimes with a few reddish-brown streaks and sometimes apically dark-tipped, midrib not excurrent ; *male glumes* 3–4 mm. long, suffused light orange-red and thickly covered with short dark-reddish streaks, otherwise similar to the female glumes. *Achene* obovoid, trigonous with prominent angles, 1·2–1·3 mm. long, 0·8–1 mm. broad, reddish-brown muricate-trabeculate on a fuscous ground colour, shortly beaked.

Tanganyika : Tabora District ; Uyansi, Chaya westwards to Tura, in pools, 1250–1230 m., 5 Jan. 1926, *Peter* 34255a (B, EA).

Northern Rhodesia : Abercorn District ; Plain of Death, Chilongowela, 1440 m., in very dry ground and among dry rocks, 5 Feb. 1952, *Mrs. H. M. Richards* 600 (K) ; ibid., damp sandy ground, flat rocks, sweet smelling, 16 Feb. 1955, *Mrs. Richards* 4500 (K) ; Mporokoso District ; Mweru wa Ntipa, between Kabwe and Kabangila, 14 Feb. 1940, *Bredo* 3818 (K).

31. **Scleria hirtella** *Swartz*, Prodr. Veg. Ind. Occ. 19 (1788) ; K. Schum. in Engl. Pflanzenw. Ost-Afr., C : 128 (1895) ; C. B. Clarke in Dyer, Fl. Cap. 7 : 294 (1898), et in Dyer, Fl. Trop. Afr. 8 : 497 (1902) ; Core in Brittonia, 2 : 15, t. 3, fig. 21 (1936) ; Hutch. et Dalz., Fl. W. Trop. Afr. 2 : 491 (1936) ; Piérart in Lejeunia, Mém. 13 : 23, t. 1, fig. 4–6 (1953), var. *hirtella*.—Jamaica, *Swartz*.

Hypoporum hirtellum (Swartz) Nees in Linnaea, 9 : 303 (1834).

Scleria hirtella var. *aterrima* Ridley in Trans. Linn. Soc., ser. 2, Bot. 2 : 166 (1884).—Angola, *Welwitsch* 7143.

Scleria catophylla C. B. Clarke in Durand et Schinz, Consp. Fl. Afr. 5 : 670 (1895), et in Dyer, Fl. Cap. 7 : 294 (1898), et in Dyer, Fl. Trop. Afr. 8 : 498 (1902) ; C. B. Clarke, Illustr. Cyper. t. CXXII, fig. 1–4 (1909).—New name for certain African specimens of *S. hirtella*.

Not tufted. *Rhizome* creeping, horizontal, internodes short, 1–4 mm. thick. *Stems* arising singly, 15–110 cm. tall, 0·75–2 mm. thick below, glabrous or villous. *Leaves* 1·25–5 mm. wide, flat to plicate-revolute or plicate-involute, glabrous, villous or hirsute, especially on the midrib and margins, lower sometimes reduced to short bladed and almost bladeless sheaths ; *sheaths* glabrous, villous or hirsute, densely hirsute at the truncate or slightly convex mouth. *Inflorescence* 3·5–18 cm. long, composed of 4–15 glomerules, each of 1–8 sessile spikelets, all glomerules except the terminal becoming strongly to extremely reflexed, upper up to about their own length distant from one another, lower usually more longly spaced, up to 2 or 2·5 cm. apart, 2·5–10 mm. broad ; *spikelets* 4–6 mm. long. *Bracteoles* shortly glumiform below, otherwise aristate and densely and usually whitish but varying to blackish-ciliate, about as long as the spikelets, sometimes curved. *Lower empty glumes* similar but smaller. *Female glumes* 2–3 mm. long, midrib area and sometimes the sides usually pale- or whitish- but sometimes blackish-hirsute, pale with reddish brown streaks or patches to castaneous or dark reddish-vinaceous, midrib excurrent in a whitish to blackish bristly-ciliate awn, 0·75–2 mm. or

more long ; *male glumes* similar but 3·4 mm. long, sometimes glabrous, tending to be more reddish, midrib sometimes mucronate, sometimes muticous. *Achene* subglobose, obtusely or obscurely trigonous, 1·4-1·8 mm. long, 1–1·5 mm. broad, smooth, pearly white, extremely shortly beaked, sunken into cavities between the angles at the base.

A selection of specimens follows :—

French Guinea : Fonta Djallons, Pita and environs, quite common on gneiss rocks, Sept. 1909, *Pobéguin* 2273 (P).

Sierra Leone : Mano Salija, fairly moist sand, 29 Nov. 1926, *Deighton* 342 (K) ; N. Province ; Kasokra-Bumban, grass-field, 28 Aug. 1928, *Deighton* 1247 (BM, K) ; N. Province ; Materboi, swampy grassfields, 12 Oct. 1928, *Glanville* 88 (BM, K) ; Dimbaia, Samu Chiefdom, 25 Sept. 1951, *Adames* 250 (K) ; near Kasanko (Maforki), among tall grass in damp sandy soil, 24 Oct. 1951, *Jordan* 636 (K).

Liberia : Montserrado Co. ; savannah east of Monrovia, 31 Aug. 1947, *Baldwin* 9179 (K, NY, US).

Ivory Coast : 1937, *Scaëtta* 3074 (P).

Togo : Sokodé, road to Atakpamé, very marshy places, Aug. 1933, *Mahoux* 2166 (P).

Nigeria : Lagos, common on rocks, *MacGregor* 245 (K) ; Nupe in a swamp near Lom, not seen elsewhere, *Barter* 1561 (K) ; Northern Nigeria ; Abinsi, in bush, 15 Oct. 1912, *Dalziel* 821 (K) ; Southern Provinces ; Ondo Province and District, about 3 miles E. of Ondo, N. of the Akure Road, in *Loudetia* mat on flat rock on top of hill, 21 Sept. 1948, *Keay* (FHI 22559) (K).

British Cameroons : rocky hill opposite Mamfe, 120 m., 29 Dec. 1927, *Migeod* 280 (K).

Ubangi-Shari : marsh near Batébadja, 35 km. south-east of Bambari, 24 Jan. 1924, *Tisserant* 1425 (P).

French Cameroons : Sanaga, primitive forest, 1897, *Zenker* T472 (BM, K).

Gabon : Gaboon River, July 1861, *Mann* 1025 (K) ; Munda, Sibange Farm, 11 Dec. 1881, *Soyaux* 351 (K) ; Ndolo plain, near St. Crois des Echiras, pond, 22 Dec. 1925, *Le Testu* 5848 (P).

French Congo : Brazzaville ; Kanguezi savannah with *rabougris* trees, Pangala, 17 Nov. 1930, *Babet* (P) ; Haute Sangha ; Berberati, wet savannah, 28 Feb. 1937, *Tisserant* 3480 (P).

Belgian Congo : Lower Congo ; damp land below Stanley Pool, 270 m., 9 April 1888, *Hens* Ser. B. No. 58 (BM, BR, K) ; Mokaba, 5 April 1914, *Vanderyst* 3874 (BR, K) ; Bas Kasai [? 1914] *Vanderyst* (BR, K) ; Haut Lomami, Sakadi, marsh, 800 m., 23 May 1947, *Mullenders* 665 (BR) ; Nioka to Fataki, savannah with *Loudetia* 1800 m., 5 Aug. 1947, *Taton* 528 (BR, K) ; M'vuazi, savannah, 6 Nov. 1948, *Devred* 387 (BR).

Uganda : Budda District, March 1894, *Scott Elliot* 7441 (K) ; Ruwenzori District ; Kasamagas, 1500 m. on granite, April 1894, *Scott Elliot* 7629 (K) ; Entebbe [? 1909], *Fyffe* 191 (K) ; Kierema, grassy swampland, 1200 m., Oct. 1913, *Dümmer* 339 (BM, K) ; [without locality] 15 March 1915, *Maitland* 50 B (K) ; Bugoye, 1305 m., June 1915, *Dümmer* 2628 (BM, K) ; near Bugolobi Swamp, near Kampala, May 1929, *Liebenberg* 796 (K) ; Mengo, Namirembe, near Kampala, swampy land, 1200 m., Jan. 1931, *Hansford* 1976 (K) ; Entebbe Road, mile 3, near water at edge of swamp, 1200 m., June 1931, *Botanist*, Dep. Agric. Uganda, 2094,. (K) ; Kigezi District ; Virunga Mtns. Mgahinga–Sabinio Pass, 2250 m., damp places, 25 Nov. 1934, *G. Taylor* 2079 (BM) ; Kampala, King's Lake, boggy marsh on outskirts of lake, 870 m., 17 Sept. 1935, *Chandler & Hancock* 44 (K) ; Ankole District ; Igara, 1680 m., Nov. 1938, *Purseglove* 458 (K) ; Masaka District ; Katera-Kiebbe road, 1 mile from Katera, flat grassy areas, margin of swamp forest, 1 Oct. 1953, *Drummond & Hemsley* 4520 (K).

Kenya : Solgorien, swamp, 1350 m., Sept. 1933, *Napier* 5382 (EA, K).

Tanganyika : Iringa District ; near Ifunda, ± 1800 m., Nov. 1928, *Haarer* 1574 (K) ; N. Nyassa, Mkyusa's Country, Elephant Marsh, peaty soil, 15 Dec. 1887, *Scott* (K) ; E. Usambaras, Maramba, locally dominant in *Themeda triandra* mountain grassland, 1170 m., 16 Nov. 1932, *Greenway* 3282 (EA, K) ; Bukoba Aerodrome swamp, permanently inundated, locally dominant, 21 June 1934, *Gillman* 81 (EA, K) ; Kilimanjaro ; S.E. side, 2500 m., forest belt, in large quantity, in chalky fields, 7 March 1934, *Schlieben* 4939 (BM).

Nyasaland : [without locality] 1891, *Buchanan* 141 (BM, E, K).

Northern Rhodesia : Mwinilunga District ; Sinkabolo Dambo, in moist grassland around grey termite mounds, 21 Dec. 1937, *Milne-Redhead* 3766 (K) ; Abercorn District ;

path to Inono Source, Chilongowelo, in fairly open bush, sandy ground, 1500 m., 21 Jan. 1952, *Mrs. H. M. Richards* 499 (K) ; ibid., old Isanga Road, in bog by side of road, wet ground, 1500 m., 11 Jan. 1952, *Mrs. Richards* 547 (K).

Angola : Huilla ; plentiful on the higher spongy slopes in the mixed woods of Morro de Lopollo, but only seen in this place, March and April 1860, *Welwitsch* 7143 (BM, COI, K, LISU) ; wet meadows on the banks of the river Campula, Cuito-Cuito Cuanavale, Bie, 26 Feb. 1906, *Gossweiler* 2792, in part (COI, K).

Transvaal : Waterberg, Nooitgedacht, locally abundant, Feb. 1942, *Acocks & Naudé* 34 (PRE).

Natal : Clairmont, 3 Dec. 1881, *Medley Wood* 1428 (K).

Cape Province : Komgha District ; grassy places near Kei Mouth, 30 m., Nov. 1894, *Flanagan* 2363 (PRE).

Mascarene Islands, S. United States to Argentina and Chile.

var. **chondrocarpa** *Nelmes*, var. nov. ; a typo achaeniis tuberculatis vel trabeculatis praecipue differt.—Uganda, *Thomas* 95.

Stems 30–50 cm. tall, slightly bulbous-thickened at the base. Mouth of *leaf-sheath* produced into a tongue up to 4 mm. long, with a rounded or triangular apex. *Inflorescence* with glomerules the lower of which are sometimes very shortly peduncled, each composed of up to 12 or more sessile spikelets. *Achene* globose but more or less flattened at base and apex, obtusely to obscurely trigonous, lightly to prominently undulately tuberculate to trabeculate.

Gabon : near the Catholic Mission of Angoun, on rocks of Acé Bengom, 28 July 1933, *Le Testu* 9202 (P).

Belgian Congo : Haut Lomami, Kaniama, among granitic slabs, 875 m., Feb. 1948, *Mullenders* 2227 (BR).

Anglo-Egyptian Sudan : Imatong Mtns., Mt. Baghanj, 1800–2100 m., frequent, 13 June 1939, *Andrews* 1893 (K).

Uganda : Buganda Province ; Masaka District ; Sese Islands, 1170 m., Nov. 1904, *E. Brown* 121 (K) ; Kalangala, Bugala, on rocks in grassland, frequent, 1170 m., 5 June 1932, *Thomas* 95 (K) ; ibid., moist grassland, common, 1140 m., 2 March 1933, *Thomas* 933 (K) ; Masaka District ; Lake Nabugabo, moist places in short grass, near lake, swampy during rains, 1125–1140 m., Aug. 1935, *Chandler* 1381 (K) ; ibid., Sese Islands, Kalangala, Bugala Island, 1125 m., locally common with *Bulbostylis schimperiana* and *Eragrostis blepharaglumis* on the more eroded crests of hill slopes in *Loudetia kagerensis* grassland on a reddish-brown sandy loam overlying ironstone, 24 Feb. 1945, *Greenway & Thomas* 7173 (EA, K) ; ibid., Busawo, S. end of Bugala, abundant in short grassland, sandy soils near forest edge, 17 June 1950, *G. Wood* Y33 (K) ; ibid., Bufumira Isle (Sese), N.W. coast, wet marshy hollows near lake edge, rhizome aromatic of almonds, common, 1119 m., 18 July 1951, *Norman* 23 (K).

Tanganyika : Bukoba District ; 1110 m., June 1931, *Haarer* 2021 (EA, K).

Scleria hirtella Swartz in north and central America, including the West Indies, bears pale reddish-brown glomerules which is the general colour effect of reddish-brown glumes which are also whitish hirsute ciliate, at least on the midrib area. Lower down, in Brazil and west-tropical America, many of the white bristly hairs are replaced by black or dark brown ones.

Across in north-tropical Africa, in the Congo region for example, specimens have been collected which are a good match of the typical American *S. hirtella*, with light coloured glomerules, but usually in Africa, and especially in the south tropics, the glomerules are rather larger and very dark or blackish. It was this sort of plant, with lower stem leaves apparently not shorter-bladed as in typical *S. hirtella*, which C. B. Clarke described as *S. cotophylla*.

A rather more distinct variant of this polymorphic species I have described as var. *chondrocarpa*. Besides its undulate-tuberculate to

trabeculate fruits, its stems show a tendency to thicken at the base, and the mouth of the sheath is produced into a tongue.

It seems to call for some explanation why I am here establishing a tubercled-fruited variety of *Scleria*, while I have elsewhere been criticising the describing of such varieties of other species of the genus. The reason is that in these 'varieties' smooth and tubercled fruits are borne on the same plant, but var. *chondrocarpa* has not been found to produce both smooth and tubercled fruits but only tubercled-trabeculate, and this difference is supported by the thickened stem-base and the tongue-like mouth of the sheath.

This variety seems to be the plant identified by Piérart as var. *tuberculata* Boeck. ex Clarke, which was based on a South African plant, in my opinion representing a different taxon, omitted from this revision because of its need of further collection and study.

32. **Scleria melanotricha** *Hochst. ex A. Rich.*, Tent. Fl. Abyss. 2 : 511 (1851) ; C. B. Clarke in Dyer, Fl. Trop. Afr. 8 : 495 (1902) ; Hutch. & Dalz., Fl. W. Trop. Afr. 2 : 491 (1936) ; Piérart in Lejeunia, Mém. 13 : 20, t. 1, fig. 2 (1953).—Ethiopia, *Schimper* 830.

A rather tall but slender, sparsely to rather densely villous annual with tufted erect to slightly curved stems, 10–45 cm. tall, including an unbranched inflorescence. *Stems* 0·5–1 mm. thick, glabrous or sparsely villous but lower part mostly hidden in leaf-sheaths. *Leaves* 0·75–2 mm. wide, flattish to more or less plicate-revolute or plicate-involute, usually subdensely villous but sometimes sparsely so, lowest ones reduced to bladeless vinaceous sheaths ; *sheaths* mostly subdensely villous, truncate mouth of sheath often hirsute. *Inflorescence* 5 20 cm. long, the glomerules, each consisting of several crowded spikelets, sessile, 5–17, mostly becoming very strongly reflexed but some not more than patent ; *spikelets* 3–5 mm. long. *Bracteoles* indistinguishable from the lower glumes of the spikelets, linear from a narrow, tapering glumiform base, ciliate with long whitish to blackish hairs, straightish or slightly curved. *Female glumes* 2–3 mm. long, midrib densely beset with long whitish and blackish, bristly hairs, and often some shorter ones on the sides of the glumes, pale with reddish streaks and a greenish midrib, which is excurrent in a densely bristly awn, 1·5–2·75 mm. long ; *male glumes* similar but 2·25–3 mm. long, midrib 0–2 mm. excurrent, often more wholly suffused light reddish-brown. *Achene* obovoid with a truncate apex, obtusely but distinctly trigonous, 1·25–1·75 mm. long, 1·1–1·6 mm. broad, lacunose-trabeculate, sometimes with 3 smooth longitudinal areas between the angles (on the sides), creamy white, glabrous, very shortly beaked.

French Sudan : Koulikoro, 6–14 Oct. 1899, *Chevalier* 2467 (K, P) ; Kita Massif, plateau on summit, about 600 m., dry grassland, 24 Sept. 1943, *Jaeger* 70 (K).

Sierra Leone : Limbaria, near Falaba, near stream, 3 Oct. 1951, *Small* 430 (K).

Nigeria : N. Nigeria ; Vom, Bauchi Plateau, Feb. 1930, *Saunders* 59 (K) ; ibid., N. Nigeria, plains, Aug. 1930, *Lely* P. 489 (K).

Ubangi-Shari : 25 km. west of Yalinga, pond on laterite, 3 Sept. 1921, *Le Testu* 3205 (P) ; Oubangui, Quaka, pond on gneiss rocks, near Keyorédé, 17 km. south of Ippy, 13 Sept. 1925, *Tisserant* 2011 (P); Oubangui, south Bozoum, Oct. 1933, *Tisserant* 3356 (P).

Belgian Congo : Uele, about Bambesa, 1936, *Pittery* 307 (BR) ; Haut Lomami, Kaniama, granitic rocks in savannah with trees, 900 m., 20 April 1947, *Mullenders* 263 (BR).

Anglo-Egyptian Sudan : Equatoria Province ; Bahr El Ghazal, Gir, 14 Oct. 1869, *Schweinfurth*, Ser. III, 191 (K).

Ethiopia : Tigré Province ; near Gapdia, grassland, 21 Sept. 1838, *Schimper* 830 (BM, K).

Tanganyika : Uvinsa ; north of Lugufu, towards Kigamba, grass-steppe, 1070 m., 10 Feb. 1926, *Peter* 36679 (EA) ; south of Mahenge, *Schlieben* 2035 (det. Piérart—not seen by me) ; Ujiji ; Matjaso, towards Mkuti-Fl, Miombo forest, 840–960 m., *Peter* 37171 (det. Peter, cft. Kükenthal : not seen by me) ; Uha ; Birira, towards Nisusi, wet places on rocks, 1385–1280 m., *Peter* 37922 (det. Peter, cft. Kükenthal ; not seen by me) ; ibid., 1260–1400 m., *Peter* 38497.

Northern Rhodesia : Mwinilunga District ; slope E. of Matonchi Farm, in 'laterite' gravel at edge of exposed rock in open, 13 Feb. 1938, *Milne-Redhead* 4560 (BM, K).

Aegopogon gracilis Peter in Abh. Ges. Wiss. Gött., n.f., 13 (2) 109 (1928), is apparently a *nomen nudum*, given to specimens from " Ujiji, Uha, Uvinsa ", Tanganyika, and represents *Scleria melanotricha*.

33. **Scleria grata** *Nelmes*, sp. nov.; affinis *S. melanotrichae* Hochst. ex A. Rich. sed culmis elatioribus, glomerulis plerumque binis distincte pedunculatis, glumis minoribus, glumis feminaeis haud aristatis differt.—Northern Rhodesia, *Richards* 1688.

A rather short and slender, glabrescent to villous annual, with tufted stems, 10–20 cm. tall, and including a spicate inflorescence. *Stems* 0·5–0·8 mm. thick, glabrous to villous, mainly, except the rhachis, hidden in the leaf sheaths. *Leaves* 1·5–2 mm. wide, flat to slightly revolute, glabrous to villous, lower reduced to reddish or vinaceous bladeless sheaths ; *sheaths* glabrous to sparsely villous, mouth of sheath more or less truncate or slightly concave and slightly or not hirsute. *Inflorescence* 3–7 cm. long, the 4–9 glomerules, each consisting of several crowded spikelets, sessile to shortly peduncled, the peduncles often bearing 2 contiguous glomerules, sometimes patent but mostly more strongly to extremely reflexed ; *spikelets* 3–4 mm. long. *Bracteoles* much like the lower glumes of the spikelets, linear, tapering, glumiform below, aristate above, the midrib area throughout studded with longish and mostly blackish stiff hairs, straight or straightish. *Female glumes* about 2 mm. long, more or less blackish- sometimes whitish-bristly, sparsely so in the midrib area and occasionally on the sides, otherwise glabrous, midrib widely green with reddish-vinaceous sides and widely whitish margins, midrib excurrent in a sparsely blackish bristly mucro 0·25–0·5 mm. long ; *male glumes* similar but 2–2·5 mm. long, sometimes more suffused reddish-vinaceous, and then glabrous, midrib 0–0·3 excurrent. *Achene* globose or subglobose, obtusely trigonous, apex not at all truncate, 1·2–1·3 mm. long, all about 1 mm. broad, trabecular-tuberculate, white, glabrous, very shortly beaked.

Tanganyika : Ulanga District ; Mahenge, Ngongo, bare summits of rocks, above mist-forest, c. 35 km. south of Mahenge, c. 1200 m., only one plant seen, 18 March 1932, *Schlieben* 2035 (BM, BR, K).

Northern Rhodesia : Abercorn District ; firebreak above Chilongowelo, in damp sand in open spaces, 1500 m., 15 May 1952, *Mrs. H. M. Richards* 1688 (K).

Propagation of Plants.*—The publication of a book devoted entirely to plant propagation is an unusual event. This is, perhaps, not surprising, for, although the art of propagation is one of the most fundamental of horticultural skills, and is indeed the very life blood of horticulture itself, it is also one that cannot be fully mastered even in the experience of a lifetime. Furthermore, those whose practical knowledge of the subject is greatest seldom seem to be endowed with the urge or ability to share their experiences with others by expressing themselves in writing. Mr. Wright is therefore to be commended for his courage in tackling the problem of writing a book about this important subject.

The book is written from the practical standpoint, in simple language, and is said to be intended for the amateur grower. There can be no doubt, however, that everybody, both amateur and professional, who is interested in propagation will find in it some titbits of information of which they were previously unaware. The author deals with all the recognized methods of propagation, both vegetative and from seed, and touches on cognate subjects such as diseases, hybridization, pollination, seed harvesting and weed control. The book is admirably illustrated by 22 photographic plates, showing close up views of the various practical operations that are described. These illustrations would, however, have been made even more useful if references to them had been inserted in the appropriate positions in the text. The book ends with a brief subject index.

One interesting feature is that the author devotes a few pages to considering the anatomical structure of the plants in relation to their propagation by vegetative means, particularly from cuttings. This approach is much to be commended, and, in the reviewer's opinion, it is a far more important aspect of the problem than is commonly realized. If this subject is to be tackled, however, it should be done well, and after consultation between the propagator and an anatomist. Some of the anatomical points made by the author that call for comment include the fact that the cambium ought to be visualized as a cylinder rather than as a " layer " which is the term that the author uses ; also that roots in stem cuttings are quite commonly initiated outside the cambium and not in the cambium itself as the author implies. Furthermore it has become customary for anatomists to avoid using the term " bast " because it has been applied in so many different senses. Plate I, which illustrates the microscopical structure of plants, will be of very little help to the uninitiated because the illustrations have not been labelled.

Another more general point that will doubtless be irksome, at least to the more scientifically minded readers, is that the author refers to plants as if they have minds of their own. For example on p. 73 we read that " Tulips, gladioli and irises like lime . . . . Narcissi are not so partial to lime, while certain bulbs, such as some lilies, dislike lime."

The points that have been criticised are quite small ones when viewed against the great wealth of information which the book contains, and no doubt it will find a ready welcome from many of those who wish for a wider knowledge of the numerous practices that are used to propagate plants.

C. R. METCALFE.

* Plant Propagation by R. C. M. Wright, N.D. Hort., pp. 192, 22 pls. London, Ward Lock & Co. Ltd. 1955. 25/- net.

THE TYPIFICATION OF CRASSOCEPHALUM Moench AND GYNURA Cass.

ROBERT O. BELCHER

Crassocephalum Moench is a well defined valid genus, centered in Africa. A single species, *C. crepidioides* (Benth.) S. Moore, has become an aggressive weed in the Far East. A clarification of its status became a necessary part of the revision of the genus *Erechtites*, recently completed by the author as his doctoral dissertation at the University of Michigan. *Gynura* Cass., which is primarily centered in Indonesia and southeastern Asia, is clearly distinct from *Crassocephalum*.

Unfortunately, botanists dealing with the African flora confused these two genera, so much so that the Vienna Congress conserved *Gynura* over *Crassocephalum*. This action is still sustained in the current list of conserved names endorsed by the Stockholm Congress, although designated as unnecessary in a footnote. This footnote refers to the comment by Sprague (Journ. Bot. 62, 143–5 : 1924), dealing with "*nomina rejicienda* not congeneric", which states : "*Gynura* Cass. (1825).—*Crassocephalum* Moench (1794), quod vel genus proprium (S. Moore in Journ. Bot. 1912, 209) vel *Senecionis* subgenus (subgen. *Gynuropsis* Muschler in Engl. Bot. Jahrb. xliii. 21, 26, 38 : 1909) est." This situation still requires definitive resolution, despite a number of papers which have appeared since 1905, including the two cited by Sprague.

Moench founded *Crassocephalum* to receive *Senecio cernuus* L. f., but wrongly interpreted the involucre of connivent phyllaries as monophyllous, on which characteristic he differentiated the genus from *Senecio*. *Senecio cernuus* (1781), however, is a later synonym of *S. rubens* Juss. *ex* Jacq. (1776–7), which indeed was cited by the younger Linnaeus. The appropriate new combination, *Crassocephalum rubens* (Juss. *ex* Jacq.) S. Moore, was made for the type species in 1912.

Cassini (Dict. Sci. Nat. 34, 389 ff. : 1825) objected to *Crassocephalum* Moench both because the name was compounded from both Latin and Greek and because the diagnosis erred in the interpretation of the involucre. He therefore gave the genus a revised diagnosis and called it *Cremocephalum*. This admirably diagnosed and properly formed name is superfluous and illegitimate, and must be rejected in favor of the earlier *Crassocephalum*, based on the same type species.

Cassini (*l. c.*, p. 390) then went on to describe a second genus, *Gynura*, as distinct from but near *Crassocephalum*. The discussion of *Gynura* is prefaced by : " Un échantillon sec, nommé avec doute '*Senecio pseudo-china* ?', dans l'herbier de M. Jussieu, nous a offert des caractères génériques analogues, sous beaucoup de rapporte, à ceux du *Crassocephalum*. Cependant il y a plusieurs différences assez notables pour nous autoriser à considérer cette plante *comme type d'un genre distinct* [italics mine], que nous caractérisons ainsi : Gynura, H. Cass. . . . . "

There follows a detailed diagnosis, of which the most significant part is the description of the style-arm appendages : " Styles à deux stigmatophores, surmontés chacun d'un appendice extrêmement long, non stigmatifère, cylindrique, obtus, hérissé de collecteurs piliformes ". This detailed description of the style arm is further amplified in the next

paragraph : " Ce nouveau genre, immédiatement voisin du *Crassocephalum*, s'en distingue par son péricline beaucoup plus court que les fleurs, par son clinanthe fimbrillé, et par ses appendices collectifères extrêmement longs, cylindriques, obtus, hispides. La grandeur et la form de ces appendices sont si extraordinaires, dans la tribu des Sénécionées, que le style qui les porte semble, au premier coup d'oeil, appartenir à une Vernoniée. Le nom de *Gynura*, composé de deux mots grecs, fait allusion à cette particularité remarquable, qui consiste en ce que l'organe *femelle* est surmonté de deux longues *queues*."

In other words, *Gynura* as Cassini conceived of it was distinguished from *Crassocephalum* by its involucre much shorter than the florets, by its fimbrillate receptacle, and especially by the extremely long, cylindric, obtuse, hispid pollen-collecting structure. This latter feature is very distinctive, and is recognizable on herbarium material even without magnification.

Differences between these two genera were also clearly set forth by Backer (Rec. Trav. Bot. Neerl. 36, 449–459 : 1939), who redescribed and discussed the four wild and one cultivated species of *Gynura* in Java, as well as " a sixth, *G. crepidioides* Benth., an African plant of recent introduction, which is better placed in *Crassocephalum* ". He also gave detailed generic diagnoses both for *Gynura*, which " differs from *Crassocephalum* by the quite different tips of the style-arms, by the abruptly and conspicuously widened base of the corolla-tube, and by the limb of the corolla rather abruptly set off from the tube ", and for *Crassocephalum*, which " differs from *Gynura* by the quite different tips of the style-arm, further by the corolla-tube being not or but slightly widened at the base, and by the limb of the corolla passing very gradually into the tube."

Cassini (*l. c.*, p. 391) made a distinction between the two genera on the basis of the receptacle (" clinanthe ") being fimbrillate in *Gynura* and not in *Crassocephalum*. This was a favorite character with Cassini, used by him in the formation of numerous genera of Composites, but it appears much more variable and less significant than he thought. Morphologically considered, it is more nearly a vegetative character than a floral one. It does not appear to be of diagnostic value in this case. The degree of development of the interalveolar line varies widely within a single capitulum and between adjacent capitula in the same inflorescence in individuals selected at random from various species of both *Gynura* and *Crassocephalum*, while the extreme condition described by Cassini as " fimbrillé " is only rarely met with in what is otherwise characteristic *Gynura*. It was, in fact, solely on the basis of " clinanthe nu " that Cassini (*l. c.*, p. 392) questioned the inclusion of his *G. dubia* in that genus. The other distinguishing characteristic mentioned by Cassini, the phyllaries much shorter than the florets, does appear valid. The florets of *Gynura* at anthesis are so elongated that virtually all of the corolla limb is visible between and beyond the tips of the phyllaries, whereas in *Crassocephalum* only the corolla tips are visible.

To these differences I would add others which do not seem to have been mentioned. The flowering branches of *Gynura* are virtually leafless for several centimeters below the capitula, giving the plant a subscapiform aspect, whereas the flowering branches of *Crassocephalum* are leafy to

the base of the inflorescence. The whitish broad tips of the anther connectives are usually exserted well beyond the corolla in *Gynura* but not in *Crassocephalum*.

It is now pertinent to examine more carefully the basic characteristic of *Gynura*, which prompted the establishment of the genus and gave it its name, the style-arm "appendage". The original description has already been quoted. Backer (*l. c.*, p. 450) described it thus: "Style arms long, thin, gradually passing into rather long, linear-subulate, hairy tips, tips inclusive $2\frac{1}{2}$ mm. or more long." In contrast (p. 458) he described *Crassocephalum* as having: "Style arms long, their truncate, $\pm$ penicillate tips bearing a well-defined, subulate, shortly papillose tail."

I am indebted to Mr. E. Milne-Redhead at Kew for directing my attention to the microscopic structure of the style-arm appendage in *Crassocephalum* as consisting essentially of a series of fused papillose hairs. These appendages have been beautifully drawn from high magnification by Mr. Peter Taylor at Kew for a number of African species, and it is to be hoped that his figures will find their way into print.

In *Crassocephalum* the style arm is stigmatic on the inner face all the way to the apex. At the apex is a three-quarters whorl of papillose hairs which point outward and slightly forward. From the center of this whorl, and continuing the axis of the style arm, there arises a slender shaft of epidermal cells, quite analogous in structure to the barbellate pappus hair, with the ends of the cells free and directed outward at an angle from the axis. Very frequently the centripetal walls of these cells appear greatly thickened, whereas the outer walls, and especially the papillae of the free ends, are very thin. These bulging thin-walled papillae occur on all sides of the conical or slightly flattened appendage. The style arm is ascended by a single line of spiral tracheary elements as a continuation of one of the two xylem strands in the style proper. This vascular strand terminates abruptly in the region of the whorl of divergent papillae and does not ascend the strand of fused epidermal cells.

The microscopic structure of the style arm in *Gynura* is in sharp contrast with the structure described above for *Crassocephalum*. In *Gynura* the style arm is stigmatic for only approximately the lower one-half of its length. This portion is usually strongly involute, being roughly C-shaped in cross-section, with the glandular stigmatic surfaces at either end of the C. The outer surface of this portion of the style arm is usually smooth, or only very slightly papillose. The stigmatic surfaces terminate abruptly, but the C-shaped structure is prolonged, the slightly irregular non-stigmatic edges usually becoming progressively more closely approximated until they may be in actual contact and simulate a slightly flattened cylinder, as Cassini did in fact describe this portion of the style arm.

Coincidentally with the termination of the stigmatic surfaces, the previously smooth outer surface of the arm becomes thickly beset with divergent papillae, the length of which approximates the diameter of the style arm at this point. The lowest papillae, at the level of the upper end of the stigmatic surfaces, may or may not be slightly longer than the others, which accounts for the controversy among some authors as to whether or not the genus has a ring (or corona) of pollen-collecting hairs

on the style arm. All of these papillae are epidermal, and cover a stratum of parenchymatous cells which extends almost to the extreme end of this gradually tapering so-called appendage, which is thus actually a continuation of the style arm proper, and not an appendage at all.

This interpretation is greatly strengthened by the fact that the xylem strand, again a single line of spiral tracheary elements, definitely continues well beyond the end of the stigmatic area for from one-fourth to as much as one-half of the remaining length of the style arm. This style arm in *Gynura* ends in a small tuft of papillose hairs which are directed forward or slightly outward, and which can not be interpreted either as a corona surrounding an obtuse dome of non-papillose cells, as in *Senecio*, or as a fused papillose appendage, as in *Crassocephalum* or *Erechtites*.

It is apparent that this entire style arm in *Gynura* is of a very different construction from that of *Crassocephalum*. I stand with Cassini, Moore, and Backer in regarding this as of generic significance. The action of the Vienna Congress in conserving *Gynura* over *Crassocephalum*, already challenged by Sprague, should be formally rescinded.

A review of the papers concerning these two genera may clarify the source of the confusion around this unnecessary *nomen conservandum*.

On the basis that *Cremocephalum*, *Gynura*, and *Emilia*, all described by Cassini, were not sufficiently distinct from one another, Lessing (Syn. Gen. Comp., 395 : 1832) lumped them together as *Crassocephalum*, to which he also transferred a true *Erechtites*, *Senecio valerianaefolius* Wolf. Among the several species explicitly reduced by Lessing to *Crassocephalum* there was no species of *Gynura*, and Lessing probably did not note this distinctive style arm of *Gynura* in forming his opinion. His concept of *Crassocephalum* has been repudiated by all subsequent authors, as indeed it should be, yet it later influenced Bentham.

De Candolle (Prodromus 6, 297–8 : 1838) took up *Cremocephalum* Cass., but altered the diagnosis from " incouronnée " (homogamous with stamens often imperfect) to heterogamous with the filiform marginal feminine florets in a few rows or one row. I have failed to find the justification for this in the material of *Crassocephalum* which I have examined. Certainly it does not seem to be true of *C. rubens*, the type species and the only one (as *Cremocephalum cernuum*) which de Candolle had, nor of *C. crepidioides*.

De Candolle also maintained *Gynura*, with a diagnosis in good agreement with the original except that the description of the style is abridged to : " styli rami apice producti in appendicem longam hispidam saepius exsertam ". He included in *Gynura* some twenty-three species, most of them new or newly transferred. Most of these are based on Asiatic material, much of it from the collections of Wallich and others distributed by the East India Company. In this de Candolle followed the clear lead of Cassini. Although the specimen in the Jussieu Herbarium which Cassini designated as the type of *Gynura* was not identified by him as to its origin, it could scarcely be other than Asiatic, where *Senecio pseudochina* was common and polymorphic enough to cause doubt as to the identity of some forms. The type of *G. dubia* Cass., moreover, was explicitly stated to have been from India.

Included among de Candolle's species of *Gynura*, however, was *G. sarcobasis* (Bojer) DC., from Madagascar. This was later, and correctly, to be recognized by Humbert (Mem. Soc. Linn. Norm. 25, 123 : 1923) as congeneric with *Crassocephalum rubens* and *C. crepidioides* (although he preferred to keep all these in *Gynura* in the conserved sense). It appears probable that the persistent determination of African species of *Crassocephalum* as *Gynura* stems from this placement of Bojer's *Senecio sarcobasis* in *Gynura* by de Candolle.

Bentham (in Hooker & Bentham, Fl. Nigr., 437 : 1849) justly objected to the description of *Crassocephalum* (*Cremocephalum*) as heterogamous, and proposed to unite *Gynura* and *Crassocephalum*, as follows : " As, moreover, the *G. aurantiaca* [Benth.], described below, is intermediate in habit, as well as in the thickness of the florets, between *Cremocephalum* and *Gynura*, it seems advisable to unite the two genera as proposed by Lessing. Moench's name of *Crassocephalum* has the right of priority, but it has been rejected as being composed of a Latin and a Greek word ; and of the two proposed by Cassini, *Cremocephalum* has only been given to one species, and is not applicable to the majority, whilst *Gynura* is not only very expressive of the principal character of the genus, but its rejection would necessitate the changing nearly five-and-twenty well established names."

That Bentham arrived at his solution of the above (unreal) dilemma without due consideration of the Asiatic species of *Gynura* is suggested by the fact that *G. aurantiaca* Benth., referred to as uniting the two genera and which was described from an African specimen as having a crassocephaloid style arm, was so named despite the prior *G. aurantioca* (Bl.) DC. This latter species is the well-known velvet plant of our conservatories. It very clearly shows the gynuroid style arm and might well serve to epitomize the genus. This confusion is maintained by Bentham (in Benth. & Hook., Gen. Pl. II, 445 : 1873), where *Gynura* is characterized by style arms slender, ending in minutely hirsute appendices, and *Crassocephalum* Moench " est *G. cernua* Benth. in Hook. Fl. Nigr. 437 ". This description of the style arm is ambiguous and could be applied to either genus.

As knowledge of the flora of the interior of Africa developed, additional crassocephaloid species were recognized and named, sometimes being placed in *Senecio* and sometimes in *Gynura*. The developments in this period, in which the identities of *Gynura* and *Crassocephalum* were thoroughly merged, are well summarized by Moore in the paper cited by Sprague. The logical conclusion was reached when O. Kuntze (Rev. Gen. Pl., 331–2 : 1891) recognized the priority of *Crassocephalum* and transferred all those species of *Gynura* which he had collected on his world trip to the prior genus, without regard to style-arm structure and their natural affinities. This action by Kuntze may well have inspired the decision at the Vienna Congress to conserve *Gynura* over *Crassocephalum*, thus affirming Bentham's position and reversing Kuntze.

Muschler (Engl., Bot. Jahrb. 43, 1–74 : 1909), in a review of the African species of *Senecio*, maintained that in Africa the genus was divisible into five subgenera : *Eusenecio*, *Notonia*, *Kleinia*, *Emilia*, and *Gynuropsis* Muschl. The genus was characterized by a terminal crown of hairs

(" *Fegehaarkranz* ") on the style arm, and the subgenera were recognized by differences in the style-arm appendage or by its absence. *Gynura* he separated from the subgenus *Gynuropsis* by the absence of the stylar crown of hairs in the former, and its presence in the latter, as in all of *Senecio*. Muschler recognized three species in his *Gynuropsis* ; namely, *S. macropappus* Sch. Bip., *S. picridifolius* DC., and *S. goetzenii* O. Hoffm.

This disposition was challenged in 1912 by Spencer Moore, who maintained that the subgenus *Gynuropsis* Muschl. was the same as *Crassocephalum* Moench, and that *Gynura* should be distinguished from *Crassocephalum* by differences in the style-arm appendage rather than on presence or absence of the *Fegehaarkranz*. Moore then proposed a number of new combinations in *Crassocephalum* for African species previously published as *Gynura*, including several of his own devising, and including *Crassocephalum rubens* (Juss. *ex* Jacq.) S. Moore as a replacement of *C. cernum* (L. f.) Moench for the name of the type species. The inclusion of *G. amplexicaulis* Oliv. & Hiern in this list, however, was unfortunate, since this species is a true *Gynura*, one of several African members of this genus.

In rebuttal Muschler (Fedde Rep. Sp. Nov. 11, 113–119 : 1912) contended that *Gynura* was only a later synonym of *Crassocephalum*, but that since it had been conserved it would have to be used. He accordingly made the new combination, *Gynura rubens* (Juss. *ex* Jacq.) Muschler, and admitted three other African species to *Gynura* ; namely, *G. sarcobasis* (Bojer) DC., *G. crepidioides* Benth., and *G. vitellina* Benth. Muschler made no reference whatever to any Asiatic (i.e., true) species of Gynura. That Moore did recognize true *Gynura* in the African flora is clearly indicated by his exclusion of *G. miniata* Welw. from *Crassocephalum*.

At this same time Muschler also reaffirmed the validity of his subgenus *Gynuropsis*, and presented a table (*l. c.* p. 118) for distinguishing among the subgenera *Emilia* and *Gynuropsis* of *Senecio* and the genus *Gynura* in both " juvenile " and " adult " stages. Again the chief distinction was the absence of a stylar corona in *Gynura*, which also had an appendix very long and thickly beset with hairs, and the presence of a stylar corona in *Gynuropsis*, the appendix of which was equally as long as the style arm (in contrast with *Emilia*, in which the appendix was only one-third as long as the style arm). Eight of Moore's species of *Crassocephalum* were placed by Muschler in *Senecio* subgenus *Gynuropsis*, three he left alone as unkown to him, and four (above) he placed in *Gynura*.

Humbert (*l. c.*, p. 123) reviewed the papers by Muschler and by Moore. He cited Muschler's distinction between the genus *Gynura* and the subgenus *Gynuropsis*, and pointed out that the assignment of *G. sarcobasis* (and of *G. crepidioides*, which he considered as synonymous with it) to *Gynura* was contradictory, since that species agreed precisely with the characterization of *Gynuropsis* in possessing a style arm with a corona. He correctly cited Moore as considering the subgenus *Gynuropsis* as none other than the ancient genus *Crassocephalum*, but apparently attributed the separation of this group from *Gynura*, on the basis of the former having a ring of pollen-collecting hairs at the base of the style-arm appendage, to Moore rather than to Muschler. Humbert very properly emphasized that the development of this " *anneau de poils collecteurs* " is

quite variable within the group of species under consideration, being, for example, quite prominent in *G. sarcobasis* and often inconspicuous in the otherwise closely related *G. rubens*, whereas in *G. sonchifolia*, " un vrai *Gynura* (*sensu stricto*) ", the " *poils collecteurs* " are often a little longer toward the base of the appendage [i.e., simulating an *anneau* or *Fegehaarkranz*]. He therefore preferred to conserve *Gynura* in the extended sense of Bentham, and to include in it *Gynuropsis* Muschler as well as *Crassocephalum*.

Although this position is in line with the recommendation of the Vienna Congress, it appears that Humbert, in demolishing the basis for separating *Gynuropsis* from *Gynura in sensu latiore*, misinterpreted the point of Moore's paper, which was that the African species both of *Senecio* subgenus *Gynuropsis* and of *Gynura* in this wider sense compose *Crassocephalum*, a genus clearly distinct from and not to be merged with *Gynura* Cass. To repeat, the distinction drawn by Moore depended upon the morphology of the style-arm appendage, and the issue of the presence or absence of the corona of pollen-presenting hairs at its base was not raised by him at all.

Afzelius (Acti Hort. Berg. 8, 123–219 : 1924) in his studies of embryology and cytology in *Senecio* and related genera, briefly reviewed (pp. 125–6) the history of *Crassocephalum* and *Gynura*. He sided with Moore in maintaining them as distinct genera. It was not specified whether he did so because of embryological and cytological differences, or because of the morphological arguments advanced by Moore, but the latter is implied.

In conclusion, *Crassocephalum* is to be maintained as a genus, with the synonymy, diagnosis, and typification given below.

Crassocephalum *Moench*, Meth. Pl., 516 (1794) ; Lessing, Syn. Gen. Comp., 395 (1832) *pro parte*, *excl. Gynura et Emilia* Cass. *et Cr. valerianaefolium* ; S. Moore, in Journ. Bot. 50, 209–213 (1912) ; Backer, in Rec. Trav. Bot. Neerl. 36, 449–459 (1939).

Cremocephalum Cass., in Dict. Sci. Nat. 34, 389 (1825) ; DC., Prodr. 6, 297 (1838).

Gynura Benth. & Hook. f., Gen. Pl. 2, 445 (1873) *pro parte* ; Dalla Torre & Harms, Gen. Siphon., 562 (1906) *pro parte* ; Humbert, Comp. Madagas., 123 (1923) *pro minore parte* ; *non Gynura* Cass., in Dict. Sci. Nat. 34, 391 (1825).

Senecio subgenus *Gynuropsis* Musch., in Engl. Bot. Jahrb. 42, 38 & 57 (1909).

Capitula homogamous, discoid, calyculate ; involucre uniseriate with phyllaries connivent ; style arms tipped with a long erect or reflexed non-stigmatic and non-vascularized appendage of fused papillose hairs.

Type species : *Crassocephalum rubens* (Juss. *ex* Jacq.) S. Moore, in Journ. Bot. 50, 212 (1912).

The only species of *Crassocephalum* known to have become a part of the composite weed flora outside of Africa and Madagascar is *C. crepidioides*. Its synonymy, distribution, and relationships, and the confusion of it with *Erechtites hieracifolia* (L.) Raf. *ex* DC., are discussed below.

Crassocephalum crepidioides (*Benth.*) *S. Moore*, in Journ. Bot. **50,** 211 (1912).

Gynura crepidioides Benth., in Hook. f., Fl. Nigr., 438 (1849).

? Senecio diversifolius A. Rich., Tent. Fl. Abyss. **1,** 437 (1848) ; *non* Du Mort., Fl. Belg. Prodr., 66 (1827).

? Senecio (*Crassocephalum*) *crepidioides* (Benth.) Aschs., in Schweinf., Beitr. Fl. Aethop., 155–6 (1867) ; *et* vars. *subincisus* Aschs., *l. c.*, p. 156, *et diversifolius* (A. Rich.) Aschs., *l. c.*, p. 156.

This species in recent years has become widely distributed eastward out of Africa and Madagascar into the East Indies, India, southeastern Asia, and the Philippines, and is still actively spreading. Material lately received at the U. S. National Herbarium from the Ryukyu Islands has included it for the first record in that area. Although it seems not to be known yet from the New World or Australia, its eventual appearance in both may be confidently expected.

The full extent of its spread in the Orient is scarcely recognized because it has become extensively confused with *Erechtites hieracifolia* var. *cacalioides* (Fisch. *ex* Spreng.) Griseb. The majority of non-African specimens of *C. crepidioides* seen by this author have been thus misidentified, and most Oriental specimens labelled *E. hieracifol'a* have actually been *C. crepidioides* instead.

No less an authority than Merrill (Plant Life Pacific World, p. 143 and f. 185 : 1945) has given this error sanction in print : " Two species of the American *Erechtites*, both with *pink flowers* [italics mine], may be dominant wherever they have been introduced, *E. hieracifolia*, fig. 185 A, and *E. valerianaefolia*, fig. 185 B." The figures cited evidently have been reversed in numbering, for fig. 185 A shows the typical congested inflorescence and pinnatifid leaf of *E. valerianaefolia*, whereas fig. 185 B shows the habit of *Crassocephalum crepidioides* with undivided upper leaves and a superficial resemblance to some states of *E. hieracifolia*, which however never has pink florets.

C. crepidioides is easily distinguished from *E. hieracifolia* by differences in achene, floret, style-arm, appendage, pubescence, and foliage. The achene of *C. crepidioides* is slender, cylindrical, bright to dark brownish red, with weakly developed sharp and narrow ribs, whereas that of *E. hieracifolia* is plump, narrowed both toward base and toward apex, dark brown with light brown cartilaginous ribs that are thick and rounded. The former species is homogamous with all florets equally slender and with reddish corollas ; the latter is heterogamous with the marginal row or rows of florets much more slender than those of the interior, and with a whitish to yellowish-green corolla. The style-arm appendage of *C. crepidioides* is 0·3 to 0·4 mm. long, and is frequently curved or coiled, whereas the appendage of *E. hieracifolia* is about 0·05 mm. long and erect. The style-arm appendage of *E. valerianaefolia* is more nearly like that of *C. crepidioides*, but even so scarcely exceeds 0·1 mm. in length.

The pubescence of *C. crepidioides* is a very short, closely appressed, almost felt-like tawny covering on the stems, peduncles, bracteoles, and involucres which, when once recognized, is valuable in the identification even of

sterile material. The basic pubescence of *E. hieracifolia* is a short white suberect unicellular hair, to which may be added in varying degrees of distribution and intensity a longer multicellular tapering white hair which upon drying develops a beaded appearance. The basic leaf pattern in *C. crepidioides* is ovate, petiolate, and subentire to lyrate-pinnatifid, whereas the leaf of *E. hieracifolia* is lanceolate, sessile or subpetiolate, and irregularly coarsely toothed.

Backer (*l. c.*, p. 458) gives an interesting account of *C. crepidioides* in the East Indies : " Plant of tropical Africa, introduced into other tropical countries (Ceylon, Sumatra) ; about 1926 found for the first time in the Dutch Indies in the neighborhood of Medan (Sumatra) ; from there purposely introduced into Java, where it has run wild in several localities, and is likely to become a common weed ; 250–1500 m. alt. ; fields, tea- and cinchona-plantations, river- and road-sides." The earliest collections which I have seen from the Orient are one from Madura in Madras Presidency, dated 8 Sept. 1925, and another from a point slightly west of Kunming in Yunnan province, China, dated Aug. 1925.

Humbert (*l. c.*, p. 122–3) has asserted that *Gynura crepidioides* Benth. is a later synonym of *G. sarcobasis* (Bojer) DC. Humbert cited the type collection by Bojer, as well as collections by D'Alleizette, Perrier de la Bathie, Catal, Viguier & Humbert, and Scott Elliott 1928. I have seen a Scott Elliott 1928*b* (K), which I considered distinct from *C. crepidioides*, and the Bojer type, which in my opinion also differed, although there certainly is a close relationship. Mr. Milne-Redhead, who had specimens presumably of both species being raised at Kew when I was there in 1951–52, was kind enough to show them to me. At the time I left, those which we considered to be *C. crepidioides* had already flowered, whereas those which appeared to be *C. sarcobasis* were still only in bud, although planted at the same time and growing on the same bench with the former. Mr. Milne-Redhead has more recently stated (personal communication, 1955) that he has compared the type of *G. sarcobasis* with material from southern Africa and is convinced that it is a species distinct from *Crassocephalum crepidioides* and occurs on the mainland of Africa as well as on Madagascar.

In this connection it would be desirable to inquire more closely into the status of *Senecio diversifolius* A. Rich., and of the two varieties of *S. crepidioides* (Benth.) Aschs. The former appears by its description to be *C. crepidioides*, as thought by Ascherson and by Moore. I have not seen the Dillon specimen which was Richard's type. The name is of course a later homonym of *S. diversifolius* Du Mortier (1827), and so the specific epithet given a year later by Bentham must be taken up.

Ascherson's inclusion of Bentham's species in *Senecio* foreshadowed the position of Muschler, discussed above. The varieties, which were based on differences in the cutting of the upper leaves, seem at first glance scarcely justified. But in connection with the alleged oneness of *C. crepidioides* and *C. sarcobasis* they take on added interest. I did not see any duplicates of either of the specimens cited by Ascherson. The originals, presumably at Berlin, are doubtless destroyed. From the brief characterizations, however, Ascherson could equally well have been dealing with extreme leaf forms of *C. crepidioides* or with *C. crepidioides* as var. *subincisus* and *C. sarcobasis* as var. *diversifolius*.

The studies of Afzelius, mentioned above, are suggestive in this connection, although not definitive. He found a haploid chromosome number of 10 for *C. rubens* (p. 185 & fig. 23g), and of 20 for " three forms of *Crassocephalum crepidioides* (fig. 26h), two from Central Africa and one from Madagascar " (p. 187). He considered (p. 205) that these two species formed a polyploid series. There is no further clue to the statement that he had three forms of *C. crepidioides*, and no way to ascertain if any was referable to *C. sarcobasis*, unless the specimens have been preserved at Stockholm, a possibility I did not investigate. The source of the achenes from Central Africa was Robert E. Fries (p. 124) ; the source for Madagascar material was not specified. Determinations of species were made for Afzelius by Mattfeld and by Spencer Moore, and presumably the latter determined the species of *Crassocephalum*.

Resolution of this tangle necessarily laid outside the scope of my basic problem, which was to clear up the confusion between *C. crepidioides* and *E. hieracifolia*. Pending its solution, and based on the admittedly slender differences noted in the key below, I prefer at present on conservative grounds to maintain as separate these three species of *Crassocephalum*. I distinguish them as follows :

Peduncle with only one capitulum, leaves simple or lobate ; florets light to dark magenta or powder-blue . . . . . *C. rubens*

Peduncle with several capitula

Peduncles, leaves and bracts subtomentose with short, tawny appressed unicellular hairs, upper leaves subentire or with a single lobe on either side at the base of the blade ; florets buff with reddened lobes . . . . . *C. crepidioides*

Peduncles, leaves, and bracts beset with spreading multicellular hairs, upper leaves all pinnately several-lobed ; florets magenta *C. sarcobasis*.

Partial list of specimens of *Crassocephalum crepidioides* examined from the Orient, with the herbaria in which they are located designated by the symbols proposed by Lanjouw in the Index Herbariorum :

India (including Pakistan) : Madras Presidency, Madura district, 4600 ft., 8 Sept. 1925, *Jacob 77051* (K) ; Billigirirangan Hills, Attikan, 5200 ft., Dec. 1938, *Barnes 538* (GH) ; Mysore, Bedugula, 21 Sept. 1939, *Barnes 849* (GH) ; Bastar State, Kanger Valley, 22 Feb. 1945, *Mooney 2591* (K) ; Orissa, Karlapat, Kalahandi, in road cutting near Tikrapara, 19 Dec. 1948, *Mooney 3177* (K) ; E. Himalaya, *Biswas 4467, 4503* (GH) ; Assam, vicinity of Ledo Road, 1945, *U. S. A. T. C. 2, 182, 223, 232, 257, etc.* (US).

Burma : Kalaw, 13 April 1934, *Dickason 5314* (GH) ; South Shan States, Taunggyi, 1934, *Malaise 250, 377* (S).

Java : Batavia, Pasir Honje bij Leunriliang, 20 July 1934, *Brink* (K), *Van Steenis* (K).

Sumatra : Karo Highlands, Berastagi, 4 June 1928, *Hamel 435* (GH) ; Deleng Singkoet, 8 June 1928, *Hamel & Rahmat Si Toroes 531* (GH).

Philippines : Mindanao, Bukidon, Kaatoan, cinchona plantation, " green leaves used as salad ", 9 Nov. 1948, *Tadeo 6009* (GH) ; Samar, Loquilocon, Wright, 15 Apr. 1948, *Sulit 6061* (GH) ; Negros Oriental, Cuernos de Negros, Guinsuan Creek, 5 June 1948, *Edano 7345* (GH ; this and the preceding *Sulit 6061* have unusually large leaves, to 20 cm. long and 8 cm. wide in *Edano 7345*, other features not changed. Shade forms ?) ; Luzon, Baguio, Jan. 1949, *Wohler 56* (S).

Malaya : Perak, Sungai Krian Estate, sea level, 5 Nov. 1938, *Spare 36046* (GH, K).

Siam : Loi, Kao Kerading, Feb. 1931, *Kerr 20415, 20416, 20423* (K) ; Kinyu Sayok, about 120 km. n. w. of Kanburi, 17 July 1946, *Kostermans 1180* (GH).

INDO-CHINA : S. Annan, Dalat & vicinity, on sandy river bank, 1932, *Squires 797* BM, G, GH, K, S) ; Laos, Muang Baw, Wiengchan, 27 Apr. 1932, *Kerr 21270* K) ; Tonkin, Haiphong, 1927, *Clemons 4269* (K).

CHINA : Yunnant open meadows on the hills, Lat. 25° 30′ N., Long. 98° 15′ E., 6000 ft., Aug. 1925, *Forrest 27181* K ; Kwangsi, Yung Hsien, Ta Tseh Tsuen, 1933, *Stewart & Cheo 1130* (G, GH, S, W ; Kwangsi, mtns. surrounding Pa Lau village near Sui-luk, S. W. of Nanning, March 1933, *Tsang 21880* (BM, GH, S ; Kwangsi, Shang-sze district, Shap Man Taai Shan, near Ping Hoh village, S. E. of Shang-sze, Kwangtung border, Mar. 1933, *Tsang 21981* (BM, S) ; Kwangsi, Waitsap district, Se Tze Shan, along Kwangtung border near Tung Chung village, Dec. 1933, *Tsang 23324* G, GH, W) ; Kwangtung, Wung Yuen district, Fan Shiu Shan, Oct. 1933, *Lau 2683* (GH .

HAINAN : Ching Mai District, Pak Shik Ling & vicinity, Ku Tung village, 2 Jan. 1933, *Lei 323* (K, US) ; Ch'ang-kiang District, Tai Tin Shan, 17 Mar. 1933, *Lau 1335* (BM, GH) ; Dung Ka, 1700 ft., 1932–3, *Chun & Tso 43904* (GH, K, US ; Po-ting, Apr. 1935, *How 71591* (G).

RYUKYU ISLANDS : Okinawa Island, Naha, near Yogi Agricultural Institute, 20 June 1951, *Walker, Tawada & Amano 5724* (US ; Ryukyu, Okinawa Prefecture, 8 Jan. 1952, *Amano 6943* (US).

Development of Plant Embryos.*—There has, in recent years, been renewed interest in the development of plant embryos from the fertilized egg cell, and in the events that lead up to fertilization. This interest has been stimulated in part by the publication of 2 books on plant embryology by Maheshwari and Johansen respectively, both of which books have been reviewed in this journal (Kew Bull. 140–42 and 349–50 ; 1951), and both of which have taken their places amongst the standard works on the subject. Professor Wardlaw's " Embryogenesis in Plants ", which has now appeared, differs from the 2 previous works in that it deals with all classes of plants ranging from the Algae to the angiosperms, and because the subject is approached from the dynamic, and not from the purely descriptive, angle. The significance of the facts that we know about embryology in elucidating the phylogeny and taxonomy of plants are also discussed. The author also deals with deviations from the normal course of events such as apomyxis, and the occurrence of monocotylous embryos in a few species from families such as the Ranunculaceae that are otherwise dicotylous.

On the dynamic side the main thesis which the author presents is that the first division of the zygote, and the subsequent behaviour and cellular organisation of the young embryo, are probably controlled by chemical substances in the nature of auxins, the behaviour of which is, in turn, controlled by genes. Furthermore a patternized distribution of metabolites always underlies and precedes the visible morphological and histological patterns. This viewpoint is reiterated throughout the book, and in the " General Conclusions " we read that " The characteristic development of an embryo is due to a whole nexus of factors and relationships ; and while genetical factors are primary, other, essentially extrinsic, factors are among the proximate causes of the observed developments ". It is quite evident, and no doubt the author would agree that

* Embryogenesis in Plants, by C. W. Wardlaw. Pp. ix + 381 ; 83 figs. London, Methuen & Co. Ltd. 1955. 42/- net.

we at present know so little about the physiological aspects of the subject that any views about it must be speculative. The events that take place in the embryo sac of an angiosperm, or in the interior of an archegonium, are in some respects reminiscent of what might occur in a miniature witch's cauldron, in which reaction systems, auxins, genes and so forth take the place of the traditional ingredients of the witch's brew. To carry the analogy a little further, one might ask oneself who or what replaces the witch. Whatever this underlying cause may be, the outcome of its operations seems to be more predictable than those that are generally associated with witchcraft, for, in each species of plant, the sequence of cell divisions and subsequent patternized organization of the cells take place in such a consistently regular manner that attempts have been made to use them for purposes of taxonomic classification.

How far the facts of embryology are valuable in taxonomic and phylogenetic studies is at present somewhat uncertain. On the one hand the reader is told (p. 245) that in certain of the cruciferae, for example, systematic grouping based on embryological data does not coincide with that based on the usual floral criteria. Lebègue's explanation of this discrepancy, as quoted in this book, is that " floral construction is a considerably less ancient manifestation of evolution than the primary development of organisms as revealed by the embryology ". This argument reminds one of the perennial problem of whether the hen or the egg " came first ". Nevertheless, embryological studies do sometimes point to interesting, even if somewhat controversial, taxonomic conclusions. The following examples amongst the angiosperms may be noted. (i) The Resedaceae resemble the Cruciferae in their embryology but are " more precocious ". (ii) Although the herbaceous and woody Rosaceae show considerable differences in their embryological characters, there is, amongst the herbaceous Rosaceae, a considerable uniformity in the embryological pattern in spite of the considerable diversity of floral structure by which it is accompanied. (3) Although embryological studies do not yet permit a complete phylogenetic classification to be drawn up, there is, we are told on p. 268, evidence that " the monocotyledons may well be a polyphyletic group ". Assertions such as these should at least arouse the taxonomist's interest.

It is not possible here to draw attention to the many other interesting facts and opinions which the author records and expresses in the 16 chapters into which the book is divided. Indeed it would be difficult for any one botanist to discuss critically the implications of all that is said concerning such diverse groups as the Algae, Bryophyta, Pteridophyta, Gymnosperms and Angiosperms. It must suffice to say that every chapter provides much food for thought, and the book deserves the attention not only of the specialist in embryology, but also of those botanists whose particular interest lies in one or more of the plant groups whose embryology is described. The extensive bibliography, and the abundant line drawings by which the text is illustrated, will also be welcomed by many readers. A book that summarizes what is known of the subject so effectively, and in which the more speculative topics are presented in such a stimulating manner, should have a wide appeal to botanists with many different viewpoints.

C. R. Metcalfe.

A NEPHROLEPIS FROM WEST AFRICA.

F. Ballard

Nephrolepis pumicicola *F. Ballard* spec. nov., a *N. undulatae* (Afz.) J. Sm., rhizomate longo erecto, frondibus erectibus longioribus angustioribus, pinnis suboblongis parvis valde numerosis distinguenda.

An erect fern. Rhizome slender, upright, up to 10 cm. long ; roots wiry and stilt-like. Fronds up to 1·2 m. high ; stipes up to 35 cm. long, stramineous, sparsely covered with linear or hair-like soft pale brown scales ; lamina linear, tapering gradually above and below, up to 85 cm. long, 3·0–3·5 cm. broad, herbaceous, pinnate, up to 100 (or more) jugate ; rhachis similar to stipe but less scaly except for small tufts of hair-like scales at the base of each pinna ; pinnae closely placed, patent, sessile, lanceolate-oblong to suboblong, auriculate on acroscopic side of base, up to 15 mm. long, 6 mm. wide, lower pinnae becoming widely separated downwards and vestigial, glabrous above, glabrous or very sparsely fibrillose below, lime-spots on marginal vein endings, margins more or less shallowly crenate. Sori half way between midrib and margin, facing or slightly oblique to apex. Indusium semi-orbicular to reniform.

British Cameroons : Cameroons Mtn., between Isobi and Bibundi, 30 m., 1922 lava flow, terrestrial fern growing in crevices, with erect stem and fronds ; pinnules horizontal, 17 Jan. 1951, *R. W. J. Keay* FHI 28655 (type in Kew Herb., isotypes in Brit. Mus. Herb. and Forest Herb. Ibadan) ; Liloka, 1320 m., collected from the inside wall of one of the 1922 craters, April 1920, *T. D. Maitland* 1091 ; Nvango, 2280 m., on lava flow from Meyer crater, Jan. 1930, *T. D. Maitland* 961 ; 1350 m., Feb. 1862, *G. Mann* 1396 ; Bibundi, on 1922 lava flow, 15 Nov. 1928, *J. Mildbraed* 10678.

St. Thomas Island : Lagua Amelia Peak, Aug.–Sept. 1905, *A. Chevalier* 13650 ; marshy ground, 1500 m., 1861, *G. Mann* 1106.

This fern seems always to be associated with volcanic lava and in spite of the apparent sterility of such an unpromising habitat nevertheless succeeds in establishing itself in cracks and crevices of old flows. Its stiff erect habit is in striking contrast to that of most other species of the genus.

Much of the material examined was collected on the lava flows on the Cameroons Mountain which resulted from the devastating eruption of 1922. The two specimens collected in St. Thomas Island, an island of volcanic origin, must also have had close associations with lava. *Chevalier* 13650 was collected on Lagua Amelia Peak which is an extinct volcano. *Mann* 1106, from 1500 m. altitude, was probably collected in the marshy ground within the crater of the same volcano.

A new combination in *Orobanche*.

Orobanche ramosa var. **brevispicata** (*Ledeb.*) *R. Grah.*, comb. nov.

O. muteli F. Schultz in Mutel, Fl. Fr., **2,** 353 and Add. 448 (1834).

Phelipaea ramosa β brevispicata Ledeb., Fl. Ross., **3,** 313 (1847).

R. A. Graham.

A NEW GRAMMITID FERN FROM LIBERIA.

F. Ballard

Ctenopteris punctata *F. Ballard*, sp. nov. Rhizoma breve ; paleae lanceolatae, rufo-brunneae, sparse et irregulariter pilis minutissimis debilibus laxe fimbriatae, usque 6 mm. longae. Stipites usque 2 mm. longi, pilis rufo-brunneis confertis patentibus 1 mm. longis vestiti. Frondes lanceolatae, usque 30 mm. longae, 6 mm. latae, coriaceae, apicem et basin versus sensim angustatae, dimidio costam versus pinnatifidae, utroque pilis brevissimis patentibus plus minusve vestitae et glandulis vesiculosis albis 40–50μ diametro 2–3 aggregatis punctatae ; laminae lobi basi 2–2·5 mm. lati, obtuse triangulares vel suboblongi, integri, 3–5 soris orbicularibus praediti. Sporangia nuda.

A curious little epiphyte notable for the minute chalk-white vesicles scattered in groups of 2 or 3 over the lower surface of the frond. A few are present on the upper surface as well. In the dried specimens examined the vesicles are devoid of liquid contents but, unlike the vesicular glands of *Atriplex* sp. and others, the wall of the vesicle is rigid and does not collapse on drying. The glands, if glands they be, are subspherical in shape and are faintly striated.

Liberia : Sinoe Co. ; Butaw, on high tree, March 17, 1948, J. T. Baldwin 11493 (type in Kew Herb.).

The limits of the three Grammitid genera ; *Grammitis*, *Xiphopteris* and *Ctenopteris* are somewhat arbitrarily drawn, as already indicated by Copeland. The placing of a new species frequently presents difficulties but the present plant would appear to fall within the ambit of *Ctenopteris* as interpreted by Copeland in his Genera Filicum.

Sarcopodium roseum (*Corda*) *Fr.*

The following appears to be the first British collection of the above fungus : On basal internode of last year's stem of *Ballota nigra*, on the north wall of Venta Icenorum, Norfolk, I.8.1955.

This species, described by Corda in 1837 under the name *Tricholeconium roseum*, has been reported from Europe on eleven host genera, including *Ballota*. Authentic material from Corda in Kew herbarium well matches the Norfolk collection.

Judging from the description the genus *Periolopsis* R. Maire, described from *Ruscus* in Greece, 1913, is a synonym of *Sarcopodium*.

R. W. G. Dennis.

CONTRIBUTIONS TO THE FLORA OF TROPICAL AMERICA : LX*.

New species of trees from British Guiana.

N. Y. Sandwith

Olacaceae

Cathedra guianensis *Sandwith*, sp. nov. ; ab omnibus speciebus in statu fructifero cognitis forma disci fructiferi basi in stipitem conspicuum attenuati differt ; praeterea a *C. inaequilatera* Sleumer stylo multo breviore, a *C. oblonga* Sleumer calyce multo minore sub anthesi quam disco conspicue breviore distinguitur.

Arbor parva vel mediocris, ramulis subteretibus glabris. *Folia* lanceolata, oblongo-lanceolata, ovato-oblonga usque fere ovata, in apicem obtusum attenuato-acuminata vel nonnunquam obtusa tantum, basi acuta vel obtusa vel rarius rotundata nonnunquam leviter inaequilateralia, 6–13·8 cm. longa, 2·5–5 cm. lata, firme chartacea vel demum coriacea, integra, glabra, laevia neque verruculoso-rugosula, siccitate subtus brunnescentia saepe nitidula, costa supra immersa canaliculata subtus crasse prominente, nervis primariis utroque costae latere vulgo 7–8 angulo acuto nonnunquam satis lato a costa discedentibus primo saepius patulis tum arcuatim ascendentibus atque marginem versus anastomosantibus utrinque tenuiter prominulis vel supra subimmersis, venulis supra haud vel sub lente tantum obviis subtus laxe reticulatis ; petiolus 7–9 mm. longus, supra canaliculatus et cum marginibus folii decurrentibus fere subalatus. *Flores* parvi, secus ramulos annotinos in fasciculis densis multifloris in axillis foliorum delapsorum dispositi, plane evoluti 4 mm. longi ; pedicelli 2–3 mm. longi, minute papillosi. *Calyx* breviter late cupularis, vix 1 mm. altus, margine integro lobulis haud distinguendis, extra minutissime papillosus. *Petala* 6, alba, lanceolata, 2·5 mm. longa, 1 mm. vel paulo ultra lata, crassa, carnosa, extra minutissime obscure papillosa intus dimidio superiore longius papillosa praeterea super antheris pilis albis barbata. *Stamina* filamentis brevissimis latis ; antherae quadrato-orbiculares vel late ovatae, 0·5–0·7 mm. longae atque latae. *Discus* cupularis, 1·5 mm. altus, jam sub anthesi calyce conspicue saltem duplo longior, glaber, margine incrassato sinuato-lobulato, basi in stipitem brevem abrupte contractus. *Ovarium* glabrum, 0·75 mm. longum ; stylus glaber, 0·6 mm. longus. *Fructus* ellipsoideus, obovoideo-ellipsoideus vel subglobosus, 1·7–1·8 cm. longus, circiter 1·4 cm. diametro, apice in umbonem oblongum vel subconicum obtusum ad 2 mm. longum e summo apice disci exsertum abrupte contractus, ceterum in disco omnino immersus ; discus fructifer valde auctus, laete flavus, totus (stipite incluso) ad 2·4 cm. longus, superne ad 1·6 cm. diametro, apice rotundato-subtruncatus ac umbilicatus, basi in stipitem latum conspicuum 7–8 mm. longum ita contractus ut formam pyriformem praebeat ; calyx persistens apice 4·5 mm. diametro ; prophyllum unicum sinuato-annulare in pedicello fructifero incrassato 3–4 mm. infra calycem insidens. *Semina* subhemisphaerica, circiter 1·2 cm. diametro.

British Guiana. 65 miles, Bartica–Potaro Road, in wallaba forest on white sand, fr. Nov. 28th, 1947, *D. B. Fanshawe* in *Forest Dept.* no. 5590 (type in Kew Herb.) : " tree 10 ft. high, 5 in. diam., unbuttressed ; leaves leathery ; calyx green, cupular ; fruit [i.e.

* Continued from Kew Bulletin, 1955, p. 376.

disk] obovoid, bright yellow, glabrous, not quite closed at apex, still young but full-grown ". *Ibid.*, 75 miles, fl. Nov. 24th, 1947, *id.* in *Forest Dept.* no. 5580 : " tree 30 ft. high, 4 in. diam. ; leaves young, thinly leathery ; flowers clustered below the leaves ; buds green ; calyx unlobed ; petals erect, white, fleshy, the hollow so formed filled with nectar ".

The species of this interesting genus are at present ill-defined, some having been described without fruits and others without flowers. The present species, which is the first to be recorded from the three Guianas, is only the second to be described from both flowering and fruiting material. It is remarkable in the fruiting stage for the broadly stipitate, and thus pear-shaped, enlarged disk which wholly envelops the fruit except for its emergent umbonate apex ; and for the presence of an annular prophyll at a considerable distance below the calyx instead of directly beneath it. The flowering material approaches *C. inaequilatera* Sleumer and *C. oblonga* Sleumer (both described from flowers alone) in general facies and in the leaves, which lack the verrucular-wrinkled surface found in other closely related species, but differs from the former in the short style and from the latter in the much shorter calyx which is conspicuously shorter than the disk. In *C. inaequilatera* the style at the time of flowering is nearly 1·3 mm. long, and is longer than the ovary. The calyx of the present species is notably short in the flowering stage, with the lobes quite obsolete, while in the fruiting condition it is narrow and scarcely flaring.

Anacardiaceae

Tapirira fanshawei *Sandwith*, sp. nov. ; *T. guianensi* Aubl. affinis, fructu duplo majore statim distinguitur, praeterea ob glabritiem omnium partium necnon foliola angusta apice longe acuminata insignis.

Arbor excelsa, ramulis foliis inflorescentiis ubique omnino glabris. *Folia* petiolo atque praesertim rhachi superne acute carinatis ; foliola 3–6-juga, longe anguste elliptico-lanceolata, apice longe (saepe 1·5 cm.) conspicue acute acuminata, basi in petiolulum 5–10 mm. longum longe sensim acutissime attenuata, 6–15 cm. longa, 1·4–3·7 cm. lata, firme chartacea vel tenuiter coriacea, siccitate supra olivacea subtus pallidiora, costa utrinque prominente, nervis lateralibus satis prominulis vel subplanis, venulis utrinque inconspicuis vel omnino immersis. *Inflorescentia* pyramidalis, 10–25 cm. longa, omnino glabra (mascula tantum visa, folio subtendente brevior). *Flores* masculi tantum visi, albi, haud numerosissimi neque congesti, pedicellis ad 2·5 mm. (saepe 2 mm.) longis. *Sepala* late ovato-suborbicularia, rotundato-obtusa, 0·75–1 mm. longa, ad 1·2 mm. lata, margine papillis ciliolata. *Petala* ovato-oblonga vel fere oblonga, apice obtusa, demum valde reflexa, 2–2·2 mm. longa, ad 1·3 mm. lata. *Discus* patelliformis, glaber, margine incrassato sinuato-crenato. *Stamina* filamentis circiter 1·75 mm. longis. *Ovarium rudimentarium* pro maxima parte e stylis 5 constans, inferne satis sparse adpresse pilosum. *Drupa* purpureo-nigra, ovoideo-oblonga, 2–2·3 cm. longa, in sicco 1·4–1·7 cm. lata, glabra.

British Guiana. 90 miles, Bartica–Potaro Road, fr. Oct. 30th, 1947, *D. B. Fanshawe* in *Forest Dept.* no. 5531 (type in Kew Herb.) : " tree 110 ft. high, 16 in. diam., unbuttressed, basally swollen, from rocky ridge on laterite (also occurs in mixed forest) ; fruit in short drooping spikes, purple-black when ripe ; seed solitary, in sweetish white mucilage ". 107 miles, Bartica–Potaro Road, ♂ fls., Nov. 15th, 1943, *id.* in *Forest Dept.* no. 4228 : " tree 110 ft. high, 28 in. diam., buttressed to 6 ft., from Kakaralli–Clump Wallaba forest ".

A very distinct species, combining large fruits with glabrous branchlets, leaves and inflorescence, and strikingly narrow long-acuminate leaflets. The flowers of the male inflorescences are not at all congested and are conspicuously pedicellate.

Lecythidaceae

Gustavia gigantophylla *Sandwith*, sp. nov. ; *G. augustae* Alm affinis, habitu cauliflоro, foliis giganteis, bracteolis majoribus statim distinguitur.

Arbor parva, trunco plerumque simplici apice foliis giganteis congestis coronato. *Folia* oblanceolata, apice verosimiliter acuminata, basin versus longissime sensim in petiolum vix distinguendum ad 1 cm. longum attenuata, 80–110 cm. longa, 18–25 cm. lata, chartacea, glabra, marginibus crenato-dentatis, nervis primariis utroque costae latere circiter 40–45 a sese vulgo 2-3 cm. distantibus patulo-ascendentibus rectis marginem versus nervo limbali subtus valde conspicuo connexis cum costa supra prominulis subtus valde prominentibus, rete venularum utrinque intricatissimo prominulo. *Inflorescentia* cauliflora ; racemi 8–12 cm. longi, crassi, angulati, dense pubescentes ; pedicelli crassi, 2 4·5 cm. longi, pube grisea vel griseo-fulva densa subtomentelli, apicem versus (circiter 5 mm. tantum sub flore) vel forsan nonnunquam inferius bracteolati ; bracteolae magnae, persistentes, ovato-oblongae, obtusae, 6–10 mm. longae, 4–6 mm. latae, extra minute puberulae *Flores* albi, magni, 13 cm. vel ultra diametro ; alabastra extra griseo-subsericeo-tomentella. *Sepala* 4 distincta, late triangularia, obtusa, 3·5–4·5 mm. longa, vulgo 8–10 mm. lata, extra griseo-subtomentella sed secus margines glabrescentia marginibus ipsis ciliolatis. *Petala* 8, patentia, spathulato-oblonga, apice rotundata, 5–6·5 cm. longa, dimidio superiore 1·5–2 cm. lata, forsan nonnunquam et longiora et latiora, tenuiter carnosa, utrinque sub lente satis dense papilloso-pubescentia. *Androphorum* flavescens, 1 cm. altum, 4 cm. diametro, minute papillosum ; filamenta 1–2 cm. longa, inferne minute papillosa ceterum glabrescentia ; antherae 2·5–3·5 mm. longae. *Ovarium* turbinatum, parte intracalycari dense tomentosa. *Fructus* (unicus visus) siccitate late subglobosus, apice truncatus, 3·7 cm. altus, 5 cm. diametro, parte apicali intracalycari applanata 3 cm. diametro teste lectore statu vivo depressa.

British Guiana. Essequibo River : Kamuni Creek, Groete Creek, in Mora forest, April 18th, 1944, *D. B. Fanshawe* in *Forest Dept.* no. 4537 (type in Kew Herb. = *Maguire and Fanshawe* no. 22888 : " tree 20 ft. high, 4 in. diam., unbranched or with one branch ; leaves terminal, tufted, oblanceolate, flowers cauliflorous in short, thick, downy inflorescences ; calyx pale cream ; petals very large, white, thinly fleshy, patent ; stamens erect-involute, connate in lower half and forming a creamy yellow bowl ; fruit greenish, globose, truncate." Cuyuni River : Camaria Road, October 1904, *A. W. Bartlett* in *Jenman Herb.* no. 8342 ; " plant 20 ft. high with simple stem and leaves at the top ; flowers large, white, fleshy, in a raceme."

Jenman 2377, Essequibo River, November 1886, apparently belongs here, but the Kew material consists only of an inflorescence and the half of a flower, showing the same large bracteoles as those of the above collections but situated lower down the pedicels, and longer and broader petals. It was described as a " tree with slender, erect, simple stem or branches 10–20 ft. high ". As only the half of a leaf, as reported on the label, was sent to Kew (it is now missing), it was presumably from a huge leaf similar to that of *G. gigantophylla*.

Mr. Fanshawe writes, " This is a very distinct localised species apparently confined to lateritic type soils. It has a very different habit from *G. augusta*, rarely branched, with this crown of very large leaves. The flowers are always cauliflorous. The tree only grows to 20 ft. high and 4 in. diam., and occurs both in Mora and miscellaneous forest. The only fruit found [now in Kew Herb.] is depressed-globose, greenish, with the capitulum [*sic*, i.e., the intracalycary zone, or the " operculum " of Miers] below the level of the top of the fruit ".

I am unable to identify this fine plant with any of the large-leaved species described from other parts of tropical America. It is perhaps related to *G. excelsa* R. Knuth, of Colombia, which has pink petals and an entire calyx-rim. The apex of all the leaves seen is mutilated, but it is probably acuminate. The type collection was identified as *G. augusta* Alm, in Bull. Torrey Bot. Club, **75,** 528 (1948).

Couratari gloriosa *Sandwith*, sp. nov. ; *C. pulchrae* Sandwith affinis, habitu, foliis saepe multo latioribus pilis stellatis multo majoribus atque multo magis sparsis indutis, pagina inferiore haudquaquam ut in *C. pulchra* arachnoideo-tomentosa, florum omnibus partibus majoribus, fructu diverso differt.

Arbor mediocris vel satis excelsa ; ramuli argute costati sulcatique, pilis stellatis minute furfuraceo-tomentelli. *Folia* elliptica, oblongo-elliptica vel obovato-elliptica, saepe latissima, apice rotundata vel truncata vel etiam leviter retusa nunc conspicue (ad 1 cm.) et acute nunc brevissime et obtuse cuspidato-acuminata, basi late rotundata et saepe cordatula vel nonnunquam obtusa tantum, 14–27 cm. longa, 7·5–16 cm. lata, utrinque costa nervisque copiose praeterea pagina inferiore satis sparse sed regulariter atque conspicue (igitur pilis tomentum arachnoideum haudquaquam praebentibus) stellato-pubescentia, ceterum ut in *C. pulchra* ; petiolus 1·5–2 cm. longus, stellato-tomentellus. *Pedicelli* robusti, flexuosi, vulgo 2·5 4·5 cm. longi, velut calyces indumento nigro-purpureo tomentelli. *Sepala* late triangulari-ovata, 6–9 mm. longa atque lata. *Petala* statu vivo vinaceo-rosea, spathulato-oblonga vel oblonga, circiter 3·5 cm. longa, 1·5–2 cm. lata, ciliata, extra stellato-tomentella (superne saepe fere subsericea) atque minute verruculosa. *Androphorum* (galea haud explanata) 4 cm. longum, glabrum, extra fere ubique crebre verruculoso-rugosulum ; galea haud echinata, 1·7 cm. lata. *Fructus* subcylindrico-ellipsoideus, nonnunquam subpyriformis et leviter curvatus, basi attenuatus pedicello plus minusve excentrico, saepe aliquantum 3–4-gonus, statu sicco 6–7·5 cm. longus, 3·5–4 cm. diametro, coriaceus, obscure longitudinaliter pluricostatus, rugosulus, haud lenticellatus, parte interzonali 2 4 mm. tantum alta, margine apicali (zona operculari) post operculi lapsum incrassato ac a parte interzonali sulco sejuncto ; operculum vertice satis conspicue radiatim sulcato, in medio conspicue depresso-umbilicato ; semina vix ad 6·5 (saepe 4·5–5·5) cm. longa, superne vix ad 2 cm. lata.

British Guiana. Porterima, left bank of Essequibo River, fl. March 9th, 1952, *C. A. Persaud* in *Forest Dept.* no. 6900 (type in Kew Herb.) : " tree 110 ft. high, 20 in. diam., from riverside in riparian forest ; leaves large, obovate, rugose ; flowers very showy, purple." Manobadin Creek, Demerara River, fl. Feb. 17th, 1940, *D. B. Fanshawe* in *Forest Dept.* no. 3086 : " tree 80 ft. high, 14 in. diam., unbuttressed, in miscellaneous forest near creeks ; leaves large, rugose, not deciduous at flowering, but flowering-

branches leafless ; buds velvety purple-black ; flowers sweet-scented ; corolla wine-red ; androecium small, on shallow, creamy cup." Moraballi Creek, Essequibo River, fr. April 12th, 1940, *D. B. Fanshawe* in *Forest Dept.* no. 3178 : " tree 80 ft. high, 14 in. diam., unbuttressed, from mixed swamp forest ; fruit a pot, purple-black ; seeds flat, elliptical." *Ibid.*, sterile, October 15th, 1929, *Sandwith* 459.

Vernacular name (Arawak), *Wadara* (broad-leaved).

This " Wadara " is an unbuttressed tree, usually of middle size, inhabiting mixed swamp forests near creeks. It thus differs from the larger, broadly buttressed " Wadara ", *C. pulchra*, in height, habit and habitat. The scattered indumentum of distinct stellate hairs, noticeable especially on the lower surface of the large (often very broad) rugose leaves, is very different from the fine arachnoid tomentum of the lower surface and veins of the leaves of *C. pulchra*. The flowers of the new species are much larger in all their parts, and the petals and androphorum are covered outside with very minute warts, a character whose constancy needs testing. The long, flexuous, robust pedicels are also worthy of note. The fruit is much smaller than that of *C. pulchra* which was well described by Eyma for Pulle's Flora of Surinam and has since been collected both in British Guiana and Brazil : the interzonary band is much narrower than in *C. pulchra*, and the rim (" opercular zone ") of the fruit after the fall of the operculum is thick and projects slightly like a cornice, so that it is separated by a furrow from the interzonary band, whereas in *C. pulchra* the comparatively wide band passes straight into the unthickened rim. The lenticels, which are so noticeable on fruits of *C. pulchra*, are absent from those of the only known fruiting collection of *C. gloriosa*. The relative size of the seeds of the two species requires investigation.

Sandwith 459, from a " young sterile tree ", was referred with doubt to *C. pulchra* in Kew Bull. 1932, p. 218, and not unnaturally, since the type of the latter species had been collected close by. Its leaves, except for their smaller size, agree exactly with those of the three other collections of *C. gloriosa*.

It is possible that the material of *B.W.* 2620, discussed by Eyma under *C. pulchra*, in his paper, " The *Polygonaceae*, *Guttiferae* and *Lecythidaceae* of Surinam ", p. 64, should also be referred to this species.

Mr. Fanshawe is convinced that *C. gloriosa* is a good distinct species. He writes that its area of distribution is the Mazaruni-Essequibo-Demerara Rivers, below the falls. On the Essequibo he found it as a riparian tree in Mora forest all the way from Bartica as least as far up as the first falls. It is partly or wholly deciduous at the flowering season. Flowering is recorded for February–March, and fruiting for April–May.

Couratari riparia *Sandwith*, sp. nov.; *C. tenuicarpae* A. C. Smith propter folia inflorescentiasque manifeste affinis, petiolis brevibus, indumento pedicelli calycisque multo tenuiore, sepalis majoribus differt ; a *C. multiflora* (Smith) Eyma, specie foliis valde similibus gaudente, habitu, racemis pro longitudine magis paucifloris, floribus praesertim sepalis majoribus, forma fructus distat.

Arbor ut videtur saepius parva, riparia ; ramuli glabri vel minute puberuli, teretes, striati, siccitate nigrescentes. *Folia* elliptica, ovato-elliptica vel saepe obovato-elliptica, apice late obtuse breviter vel satis

longe (ad 1 cm.) cuspidata, nonnunquam rotundata tantum, basi rotundata vel obtusa, raro acuta, 3·5–11 cm. longa, 2·3–5·7 cm. lata, subintegra vel satis conspicue crenato-serrata, coriacea, nitida, glabra, valde prominenter subaequaliter sed praesertim supra crebre reticulata, costa supra elevata subtus prominente, nervis primariis utroque costae latere 8–10 sursum arcuatis conspicue satis longe a margine anastomosantibus tum iteratim (saltem bis) marginem versus nervis aliis limbalibus connexis ; petiolus brevis, vix vel haud alatus, supra breviter canaliculatus, gracilis, 4–7·5 mm. longus. *Racemi* satis pauciflori, axillares atque terminales, 2–12 cm. longi, velut pedicelli calycesque minute arcte puberuli vel tomentelli ; pedicelli graciles, flexuosi, 1·2–2·5 cm. longi ; bracteae basi pedicellorum mox deciduae, 4–5 mm. longae. *Flores* expansi 4–5 cm. diametro. *Calycis* tubus turbinatus, rugosus ; sepala 6, semiorbiculari-ovata, apice obtusa rotundata, 5–7 mm. longa, 6–7·5 mm. lata, extra minute puberula, margine ciliata. *Petala* 6, rosea, oblongo-obovata vel oblonga, apice rotundata, inaequalia, 2·2–3·5 cm. longa, 0·9–2·2 cm. lata, margine ciliata, extra dimidio inferiore praesertim basin versus satis dense minute puberula. *Androphorum* explanatum 4 vel fere ad 5 cm. longum, ligula supra stamina 1·2 cm. lata, galea laevi 1·6 cm. diametro ; stamina circa annulum 40–50, filamentis circiter 0·5 mm. longis, antheris subglobosis 0·7 mm. diametro. *Ovarium* vertice convexo ad 3 mm. alto ad 6 mm. lato, 3-loculare, ovulis pro loculo circiter 8–10. *Fructus* parvus, cupulari-cylindricus, sed sub pressione siccitate turbinato-obconicus, basi in pedicellum excentricum attenuatus, 2·5–3·5 cm. longus, apice 1·4–1·7 cm. diametro vel statu applanato 2–3·5 cm. latus, tenuiter coriaceus, satis conspicue longitudinaliter costatus, reticulato-rugosus, haud lenticellatus, parte interzonali 3–4·5 mm. alta, margine apicali (zona operculari) haud incrassato ; nec operculum neque semina visa.

British Guiana. Demerara River, near Great Falls, fl. and fr. March 1898, *Jenman* 7311 (type in Kew Herb.), 7312. Demerara River, fl. May 1887, *Jenman* 3924. Demerara River, above Manobadin, fl. March 1910, *C. W. Anderson* in *Forest Dept.* no. 498. Demerara River, Baibidanni Creek, fl. and fr. March 1940, *D. B. Fanshawe* in *Forest Dept.* no. 3128. Potaro River, bank at Tumatumari, fr. July 1921, *Gleason* 314. Potaro River, common on banks, fl. March 1933, *Martyn* 391. Potaro River Gorge, frequent below Amatuk and Tukeit respectively, fr. May 1944, *Maguire and Fanshawe* 23555 and 23501 ; and between Kangaruma and Amatuk, fl. and fr. December 1948, *D. B. Fanshawe* in *Forest Dept.* no. 5836. Arabaro [Arubaru] River (Kako tributary, upper Mazaruni River), Pakaraima Range, 2000 ft., very common on banks, fl. February 1939, *Forest Dept.* no. 2838.

This " Wadara " is a river-bank tree, of small to medium size, often leaning out over the water. It is locally common on the Demerara River, the upper Essequibo River above the mouth of the Potaro, the Potaro River and the upper Mazaruni River with their tributaries in the Pakaraima Range. On the last two rivers it is a characteristic species of swamp forest. Usually it is a small tree 20–40 ft. high, with trunk only a few inches in diameter, but *Forest Dept.* 3128 was noted as 90 ft. high and 16 in. diam. With its masses of pink or pinkish-mauve flowers, often borne on leafless branches, it is one of the most striking features of the river-banks where it grows.

The relationship is with the Amazonian *C. tenuicarpa* A. C. Smith and, perhaps closer, with the Guiana *C. multiflora* (Smith) Eyma, with which I myself, after examining Smith's leafless type specimen of *Lecythis multiflora*,

should associate *C. fagifolia* (Miq.) Eyma, although Eyma preferred to keep these two species separate. *C. multiflora* (including *C. fagifolia*) differs in its normally much larger size and its habitat in mixed forest away from river-banks. It has recently been collected by Mr. Fanshawe on the Big Wineperu Creek, Demerara River (*Forest Dept.* nos. 3105, 3118), and at Mazaruni Station (*Forest Dept.* no. 3245, material agreeing well, except for its longer petioles, with the Parker specimen from British Guiana cited by Miers under *Allantoma multiflora* (Sm.) Miers). Mr. Fanshawe, who agrees with me that *C. riparia* and *C. multiflora* are quite distinct, writes that *C. multiflora* has the habit and habitat of *C. pulchra* Sandw. and is distinguished in the field as "Wadara fine-leaf", *C. pulchra* being known as "Wadara broad-leaf". *C. multiflora* differs in detailed botanical characters from *C. riparia* in the densely-flowered inflorescences which have a more obvious, often scurfy and tawny, indumentum ; in the smaller flowers with, especially, much smaller sepals ; and in the much larger (longer and broader) mature fruit. The length of the petioles and pedicels is evidently variable in these species of *Couratari*, while only fully mature fruits which have lost their operculum should be compared for their size.

C. oligantha A. C. Smith, another species of this group, differs from *C. riparia* in its papery, relatively narrower leaves which are conspicuously narrowly and acutely acuminate at the apex, narrowed and gradually tapering to the base ; in the androphorum, which is much smaller in all its parts ; and in the much narrower petals.

Eschweilera eperuetorum *Sandwith*, sp. nov. ; ex affinitate *E. alatae* A. C. Smith, sed ramulis haud alatis, foliis subopacis, nervis primariis lateralibus numerosioribus, rete venularum tenuius prominulo, sepalis petalisque longioribus, androphoro appendicibus longioribus echinato differt.

Arbor mediocris vel parva, omnibus partibus glaberrimis, ramulis striatis sulcatisque. *Folia* magna, oblonga, elliptico-oblonga vel anguste oblongo-lanceolata, apice conspicue cuspidato-acuminata, basi rotundata vel obtusa, 13–30 cm. longa, 4–13 cm. lata, satis crasse coriacea marginibus revolutis integris, subopaca vix nitidula, siccitate olivacea vel brunnescentia subtus saepe flavicanti-olivacea, costa supra prominula subtus valde prominente et inferne sensim dilatata ipsaque costata, nervis primariis utroque costae latere 16–20 angulo lato patulis marginem versus anastomosantibus atque serie duplici vel etiam triplici nervorum limbalium connexis, his cum intermediis parallelis venulisque intricatissime reticulatis supra subplanis obscuris vel tenuissime prominulis subtus conspicue prominulis ; petiolus 1 2 cm. longus, ad 5 mm. latus, supra leviter canaliculatus subalatus, subtus crebre transverse corrugatus. *Inflorescentia* terminalis ac axillaris, simpliciter racemosa vel terminalis ramulis 2 prope basin praedita ; racemi robusti, 5–14 cm. longi, rhachide 2–4 mm. lata acute angulata, haud flexuosa, glabra ; bracteae bracteolaeque facile caducae, magnae, conspicuae, ad 1 cm. longae, ad 8 mm. latae, siccitate rubescentes ; pedicelli prope basin articulati atque bracteolati, supra articulum 9–10 mm. longi, 1·2–2·2 mm. crassi, glabri. *Flores* albidi, magni, ad 7 cm. diametro, alabastris sub anthesi 1–1·2 cm. diametro. *Sepala* late ovata, apice obtusa, 8–10 mm. longa, 6–8 mm.

lata, papillis ciliata, lenticellis minutis maculata. *Petala* obovato-oblonga, 3–3·3 cm. longa, 1·7–2·2 cm. lata, glabra. *Androphorum* 4 cm. longum, ligula explanata 1·4 cm. lata, galea explanata 3 cm. lata parte apicali spiraliter incurva extra appendicibus 5–7 mm. longis intimis multo brevioribus circiter 3 mm. longis dense echinata. *Stamina* valde numerosa, filamentis ad 1·75 mm. longis superne inflato-dilatatis tum contractis, antheris 0·75–1 mm. longis 0·75 mm. latis. *Ovarium* biloculare, stylo lato conico 2 mm. longo 1·5 mm. diametro ; ovula in quoque loculo 7. *Fructus* operculo sejuncto cupularis vel turbinatus, 1·5–2·3 cm. altus, 3–4·5 cm. diametro, pedicello conspicuo ad 5 mm. crasso insidens ; pars infracalycaris late turbinata vel basi rotundata, 1·5–2·2 cm. longa, 2·8–4 cm. diametro, senectute tenuiter striato-rugosa atque muriculata ; zona calycaris prope medium fructum vel supra circumcurrens, sepalis conspicue persistentibus accrescentibus vel patentibus ; vitta interzonalis 5–10 mm. alta, senectute valde corrugata, a margine apicali zonae opercularis distincta ; operculum late conico-convexum, 1–1·7 cm. altum, 1·8–3·2 cm. diametro, apice umbonatum ; semina ovoideo-ellipsoidea, 1·8–1·9 cm. longa, 1·3–1·4 cm. lata, testa brunnea nitidula.

British Guiana. Bartica–Potaro Road, 21 miles, in wallaba (*Eperua*) forest, tree 70 ft. high, 8 in. diam., flowers off white, showy, Dec. 25th, 1948, *D. B. Fanshawe* in *Forest Dept.* no. 5831 (type in Kew Herb.) ; *ibid.*, 14 miles, in wallaba forest near Barabara Creek, tree 30 ft. high, 8 in. diam., fruit, August 26th, 1942, *Fanshawe* in *Forest Dept.* no. 3555 ; *ibid.*, same locality as last, fl. buds and fruit, August 17th, 1937, *Sandwith* 1116. Kaieteur Plateau, locally frequent by stream in low bush, tree 16 ft. high, 3–4 in. diam., fruit, May 11th, 1944, *Maguire and Fanshawe* 23402 ; *ibid.*, in woodland on white sand, tree 30 ft. high, 4 in. diam., flowers whitish, Dec. 29th, 1948, *Fanshawe* in *Forest Dept.* no. 5833.

Vernacular name (Arawak), *Kakaralli*.

In the wallaba forests by the Bartica–Potaro Road Mr. Fanshawe finds this tree up to 80 ft. in height and 8 inches in diameter. He notes that the bracts and calyx segments are accrescent, the latter crimson or crimson-edged, but green on the ripe fruit, which has the infracalycary zone reddish gold in colour, and the upper interzonal portion fawny-brown. Maguire noted the fruit as reddish, the seeds as brown.

A very distinct species, characterised by large, thick, dull (not glossy) leaves which often dry a yellowish-olive colour beneath ; numerous lateral nerves, with a complex series of connecting nerves towards the margin ; glabrous, rather few-flowered inflorescences with unusually large bracts and bracteoles and well-defined (not "receptacular") pedicels ; fairly large sepals ; unusually large white corollas, with a spirally incurved androphorum ; and a bilocular ovary. The fruit is similar in general characters to that of *E. alata*, and also to that of *E. subglandulosa* (Steud.) Miers, a species with smaller leaves and flowers and a downy inflorescence, to which A. C. Smith allied his *E. alata*, but the large persistent sepals of the latter are very distinctive.

Eschweilera (*Chytroma*) **potaroensis** *Sandwith*, sp. nov. ; *E. congestiflorae* (Benoist) Eyma affinis, forma pedicelli receptaculiformis, sepalis multo minoribus, forma necnon magnitudine fructus praecipue differt.

Arbor excelsa, omnibus partibus glaberrimis, ramulis rimoso-decorticantibus. *Folia* oblonga vel elliptica, apice brevissime cuspidato-acuminata vel truncato-rotundata, basi rotundata vel obtusa, 10–26 cm. longa, 4·8–12·2 cm. lata, crasse coriacea marginibus revolutis, integra,

utrinque plus minusve nitidula, costa utrinque prominente inferne sensim conspicue dilatata ipsaque 2-3-costata, nervis primariis utroque costae latere 12–15 ascendentibus vel angulo lato patulis marginem versus anastomosantibus, his cum intermediis supra fere planis vel subimmersis subtus prominulis, rete venularum supra haud obvio vel saltem inconspicuo subtus saepe satis prominulo ; petiolus crassissimus, 0·7–1 cm. longus, ad 5 mm. latus, supra canaliculatus subalatus, subtus crebre transverse corrugatus. *Inflorescentia* terminalis ac axillaris, vulgo simpliciter spiciformi-racemosa, terminalis nonnunquam ramulis basalibus praedita; racemi elongati, robusti, congestiflori, ad 15 cm. longi, rhachide 2–4 mm. lata, acute angulata, glabra, lenticellis parvis hic illic vulgo maculata ; bracteae bracteolaeque delapsae ; pedicelli sub articulo crassi brevissimi 2–3 mm. longi, tum sub ovario receptaculum crassum turbinato-campanulatum angulatum atque sulcatum minute lenticellatum 6–9 mm. longum superne 5–7 mm. latum ita efformantes ut flores subsessiles esse videantur. *Flores* albi, alabastris sub anthesi 1·5 cm. diametro. *Sepala* late ovata, rotundato-obtusa, coriacea, 6–7 mm. longa, 6·5–7 mm. lata, margine pallidiore lacerato-fimbriata, extra minute lenticellata. *Petala* alba, carnosa, late obovato-oblonga vel elliptico-oblonga vel interiora suborbicularia, valde inaequalia, 1·2–2·8 cm. longa, 1–1·6 cm. lata, extra lenticellis minutis maculata, denticulis papilliformibus fimbriata, glabra. *Androphorum* explanatum 2·8 cm. longum, ligula explanata 9 mm. lata, galea super ovarium inflexa atque spiraliter incurva ad 1·5 cm. diametro valde incrassata extra appendicibus luteis numerosissimis ad 5 mm. longis echinata. *Stamina* valde numerosa, lutea, et in annulo androphori basali et secus partem ligulae inferiorem inserta, filamentis vulgo 1·5 mm. longis apicem versus inflato-dilatatis tum contractis, antheris circiter 0·6 mm. longis atque latis. *Ovarium* 4-loculare ; ovula in quoque loculo 3. *Fructus* plane maturus operculo sejuncto cupularis, 4–5 cm. altus, 8–9 cm. diametro ; pars infracalycaris late turbinata vel basi late rotundata, 3 cm. longa, 6·5–7 cm. diametro, senectute crebre verrucoso-lenticellata ; zona calycaris prope medium fructum vel paulo infra circumcurrens ; vitta interzonalis 2–4·5 cm. alta, senectute valde profunde corrugata, apicem versus paulo tantum angustata sed a margine apicali zonae opercularis plus minusve revoluto distincta ; operculum conspicue conico-convexum, 2·5–3 cm. altum, 4·5–5 cm. diametro, apice stylo persistente incrassato umbonatum ; semina non visa.

British Guiana. Potaro River ; Mahdia River, 107 miles Bartica–Potaro Road, Jan. 16th, 1943, *D. B. Fanshawe* in *Forest Dept.* no. 3772 (type in Kew Herb.). " Tree 116 ft. high, 20 in. diam., buttressed to 16 ft. Leaves large, leathery. Flowers in terminal and axillary thick flexuous spikes ; buds greenish-brown, shiny. Calyx green, flushed crimson, fleshy, erect. Petals white, fleshy, dotted on outer surface. Stamens and staminodes bright yellow."

Vernacular name : known locally as " Monkey Pot ", this tree is of the " *Haudan* " type.

This tree, known from only a single collection, seems to be a very distinct species of the *Chytroma* type. It is probably nearly related to *E. congestiflora* (Benoist) Eyma and *E. simiorum* (Benoist) Eyma, differing from both in the more elongate turbinate-campanulate " receptacle " (i.e. the thickened pedicel above the joint), the much smaller sepals, and characters of the larger fruit. In addition, *E. simiorum* often has thinner leaves with obviously reticulate veinlets, and pink petals. Similar

characters of much thinner leaves and smaller fruits distinguish, according to the description, another apparent and perhaps closer ally, *E. miersii* (R. Knuth) A. C. Smith, of which I have seen no material. As Mr. Fanshawe has noted, the leaves of *E. potaroensis* are remarkably similar in texture and venation to those of the new species of " Haudan ", *E. fanshawei*, from the same region : in fact, he writes that the two species cannot yet be distinguished in the field except when in flower or fruit. So far as the herbarium material is concerned, however, the resemblance ends with the leaves, and even these are by no means identical, since those of *E. fanshawei* are relatively shorter, with fewer main lateral nerves, and shorter petioles.

Eschweilera fanshawei *Sandwith*, sp. nov. ; ob glabritiem omnium partium, folia rigide coriacea, inflorescentiam multiramosam angulatam, pedicellos breves crassos, praesertim flores pro genere minimos cum androphoro roseo-purpureo notabilis ; *E. sessili* A. C. Smith, speciei colombianae, forsan affinis sed foliis multo magis coriaceis pro rata latioribus, petiolis crassis brevioribus, florum omnibus partibus sepalis exceptis multo minoribus differt.

Arbor excelsa, ramulis glabris crebre lenticellatis facile decorticantibus siccitate nigrescentibus. *Folia* late elliptica vel suborbicularia, apice rotundata vel etiam truncata brevissime cuspidata, basi rotundata vel obtusa subsessilia, 4–10·5 cm. longa, 2·7–8·4 cm. lata, crasse coriacea marginibus revolutis, integra, glabra, utrinque plus minusve nitidula, costa utrinque acute prominente inferne sensim conspicue dilatata ipsaque saepe 2–3-costata, nervis primariis utroque costae latere circiter 7 ascendentibus marginem versus anastomosantibus, his cum intermediis supra fere planis vel subimpressis subtus prominulis, venulis majoribus nonnullis tantum obviis ; petiolus brevis, crassissimus, 2–5 mm. longus, ad 5 mm. latus, glaber, supra canaliculatus, subtus crebre transverse corrugatus. *Inflorescentia* terminalis ac axillaris, intricate multiramosa, plus minusve pyramidalis, 10–15 cm. longa, ad 17 cm. lata, omnino glabra, siccitate brunnea, ramis crebre lenticellatis his cum ramulis acute angulatis ; bracteae bracteolaeque persistentes, ovatae, acutae, concavae, illae nonnunquam ad 1·5 mm. longae, hae minores, fimbriato-denticulatae ; pedicelli crassi, rugoso-sulcati, breves, 1·5–2·5 mm. longi, ad 2 mm. lati. *Flores* parvi, alabastris 4–5 mm. diametro pallide viridibus. *Sepala* orbiculari-ovata, rotundato-obtusa, 2 mm. longa, ad 2·2 mm. lata, glabra, margine denticulis papilliformibus fimbriata, velut calycis tubus lenticellis minutis pallidis maculata. *Petala* pallide cremea roseo-suffusa, inaequalia, elliptico-oblonga, 2 majora obovato-oblonga, apice rotundato-obtusa, 5–7 mm. tantum longa, 3·5–6 mm. lata, glabra. *Androphorum* roseo-purpureum, basi stamina haudquaquam alte cingens, vix 1 cm. longum, glabrum, ligula canaliculato-plicata explanata circiter 3–4 mm. lata, galea incrassata 5 mm. diametro supra ovarium inflexa sed haud spiraliter incurvata apice ac intus appendicibus valde numerosis longis subulatis apicem versus filiformibus 3–4 mm. longis prorsus directis dense echinata. *Stamina* valde numerosa, filamentis vix 0·4 mm. longis medio inflato-dilatatis tum contractis filiformibus, antheris 0·3 mm. longis ad 0·4 mm. latis. *Ovarium* biloculare, vertice convexo-conico ; ovula in quoque loculo 3–4. *Fructus* non visus.

British Guiana. 85 miles, Bartica–Potaro Road, in mixed forest on brown sand, Nov. 3rd, 1947, *D. B. Fanshawe* in *Forest Dept.* no. 5546 (type in Kew Herb.). " Tree 110 ft. high, 24 in. diam., with flange buttresses to 5 ft., spreading. Leaves leathery, adpressed to branchlets, subsessile. Inflorescences and buds pale green. Corolla lobes palest cream with a pinkish tinge, patent. Androphore curled over androecium, pink-mauve.

Vernacular name (Arawak), *Haudan* (but this name is applied to at least five other species).

This very distinct species presents a combination of striking characteristics which has been noted in no other species of the genus. Other species with very small buds and flowers can be distinguished at once either by the shape and texture of their leaves, or the downy inflorescence, or the longer and thinner pedicels, or the colour of the petals and the shape of the androphorum. The name " Haudan " is also given in British Guiana to *E. holcogyne* Sandw., *E. praeclara* Sandw. and *E. simiorum* (Benoist) Eyma, and in Surinam to *E. corrugata* (Poit.) Miers and *E. amara* (Aubl.) Ndz., but none of these species shows much evidence of affinity with *E. fanshawei*. It is hoped that its fruit will be collected.

Eschweilera praealta (*Sprague*) *Sandwith*, comb. nov.—*Lecythis praealta* Sprague in Trans. Proc. Bot. Soc. Edinb. **22,** 431 (1905) ; R. Knuth in Engler, Pflanzenreich, **4,** 219A, 57 (1939).

Colombia. San Jose, Rio Putumayo, Aug. 7th. 1899, *Sprague* sine no. " Flowers yellow."

Sprague himself described the ovules as erect, and noted on the label that the species belonged to " § *Chytroma* ". He allied it to *L. elliptica* H.B.K., but realised that the specimens at Kew which were referred to that species by Miers are conspecific with Miers's own species *Chytroma valida*, = *Eschweilera valida* (Miers) Ndz. Knuth kept *L. elliptica* in *Lecythis* and *Chytroma valida* in *Chytroma*, without realising their possible identity. This should be settled by an examination of the type of *L. elliptica*, which Knuth himself saw in the Willdenow Herbarium at Berlin. Knuth also saw and cited as *L. elliptica H. H. Smith* 832, which agrees with the Kew specimens referred by Miers to *L. elliptica* and noted as conspecific with *Chytroma valida* by Sprague. Since *H. H. Smith* 832 has the fat conical style of *Eschweilera*, while the Purdie material referred by Miers to *L. elliptica* has the sessile erect ovules of that genus, it seems almost certain that *L. elliptica* should be transferred to *Eschweilera*.

Eschweilera (*Chytroma*) **grandiflora** (*Aubl.*) *Sandwith*, comb. nov.—*Lecythis grandiflora* Aubl. Hist. Pl. Guiane, **2,** 712, **4,** tt. 283, 284 (1775), excl. descr. fructus et t. 285, ff. 15–20 ; Miers in Trans. Linn. Soc. **30,** 219 (1875), non t. 57, ff. 1–3 ; Sagot in Ann. Sci. Nat. ser. 6, **20,** 199 (1885) ; Benoist in Lecomte, Not. Syst. **3,** 178–179 (1915) et in Arch. Bot., Caen, **5,** Mém. 1, 214, t. 46 (1931) ; R. Knuth in Engl. Pflanzenreich, **4,** 219A, 59 (1939), excl. descr. fructus ; Lemée, Fl. Guyane française, **3,** 117 (Jan. 1954), excl. descr. fructus.

French Guiana. *Aublet* (type), *Martin*, in Herb. Mus. Brit. Other collections in the Paris Herbarium are cited by Sagot and Benoist.

The affinity of this species, near *E. simiorum* (Benoist) Eyma and *E. congestiflora* (Benoist) Eyma, was realised and published by M. Benoist who, however, was influenced by the remarks of Sagot and did not admit

the validity of any of the genera which Miers had segregated from *Lecythis*. Other writers, such as Miers and R. Knuth, have maintained the species in *Lecythis*, in the restricted sense, while Eyma did not have occasion to mention it in his excellent critical notes on the *Lecythidaceae* of Surinam.

I have examined Aublet's specimen in Herb. Mus. Brit., and consider that it agrees well enough with Aublet's description and with his tab. 283 to be taken as the lectotype of *Lecythis grandiflora* ; moreover, this species is not represented in the set of Aublet's specimens which was traced to the possession of M. Henri Denaiffe at Carignan, in the Ardennes, and now belongs to the Paris Herbarium. There are also in Herb. Mus. Brit. two very good sheets collected by Martin which agree with Aublet's specimen. After seeing this material I agree with M. Benoist that *Lecythis grandiflora*, as to its branchlets, leaves and flowers, is a species related to his *L. congestiflora* and *L. simiorum* : that is to say, it belongs to Miers's genus *Chytroma*, and should therefore, in my opinion, be placed in the genus *Eschweilera*, from which *Chytroma* is not sufficiently distinct. It is evidently a local species, at any rate in Guiana, but it may have to be considered in relation to some of the Amazonian species of *Chytroma* which were described by Knuth. Salient characters of *E. grandiflora* are the large thick leaves ; large bracts and large reddish sepals ; thick, zigzag, glabrous rhachis with scattered flowers ; short and thick but still relatively narrow pedicels ; and very large pink flowers. Correctly assigned fruit has not yet been collected.

The fruit which was described and figured by Aublet, his figure being reproduced in natural size by Miers, has the size, shape and columella of a typical " Monkey-pot ", and must certainly be referred to the genus *Lecythis*. It is my belief that such a fruit was collected from the ground and wrongly associated by Aublet with the flowering material. Later writers have not suspected this, and M. Benoist could scarcely have done so, since the fruits of his *L. congestiflora* and *L. simiorum* were unknown to him (they are now known to be of the characteristic *Eschweilera* size and shape). There are other notorious instances of discordant elements in Aublet's descriptions and plates, but in this particular case there is no need to reject his name : the specific epithet, the major part of the description, two of the plates, and the specimen in Herb. Mus. Brit., all apply to the flowering material with leaves. Nor need we blame Aublet too much. As Sagot said long ago, one can rarely collect flowers and fruit on the same tree of this family : " le plus souvent on croit reconnaître, d'après la similitude des feuilles et l'analogie de pédicelle et de la grappe, dans un arbre que l'on trouve en fruit, une espèce qu'on avait recoltée précédemment en fleur " ; and he significantly added, " La lecture des descriptions d'Aublet montre qu'il parle de chaque espèce d'après l'observation de plusieurs pieds différents." Our present-day Forest Departments do the same, but with very different standards of accuracy !

THE DISTRIBUTION OF PICEA ORIENTALIS (L.) CARR.

by

Dr. H. Kayacik

Picea orientalis is one of the important trees in the Caucasus and Turkey ; it is also a favourite ornamental species for decorating parks and gardens. The tree was first discovered by Tournefort (1) on the mountains of North Anatolia, at South-East Trabzon on the Black Sea, and a brief description of the species is given in his Travels (Vol. II, p. 238) ; subsequently Pallas (2) described it as *Pinus picea*.

Some years later Bieberstein (3) recognized it as a distinct species from *Picea excelsa* (*Pinus picea*) and resuscitated Tournefort's trivial name *orientalis*. In 1855 Carrière transferred the species to the genus *Picea* (4).

Although two centuries have passed since its first discovery we have no satisfactory knowledge about its real distribution, despite the fact that the whole area in which it is found is, from a geographical point of view, comparatively small and sharply demarcated by certain natural boundries.

During this long period many geographers, botanists and foresters, some of them acquainted with the tree in its native localities, and others relying solely on travellers' reports, have mentioned *P. orientalis* in their books, articles and travel records and have given an adequate description of its appearance and characters. On the other hand, its distribution has been very little investigated ; it is only noted with a few words, and, unfortunately, such records, often contain crude mistakes. For example, Pilger (5) gives its distribution as " Gebirge Kleinasiens " (Mysien, Phrygien, Taurus, Antitaurus) Armeniens, Transkaukasiens.

According to Pilger's records *P. orientalis* should be considered a native of West and South Anatolia too, and from the time of Tchihatcheff (6) and Boissier (7) to the present day it has been widely believed, by botanists, that *P. orientalis* is native not only in the Caucasus and North-East Asia, but also in South and West Turkey. This statement has been repeated in botanical literature—even in the classical " Conifer books " (8 & 9)—and the following extract from an article by H. Czeczott (10) is a typical example :—" The surprisingly numerous stations in the Antitaurus Mts. are undoubtedly reliable : the presence there of *Picea orientalis* was noticed at different periods by Tchihatcheff (1853), Hugo Grothe (1906/7) and Brockes ".

Contrary to these records, oriental spruce is distributed as a native tree only in the Caucasus and North-East Turkey. In our opinion former

(1) Tournefort : Relation d'un Voyage du Levant, 2 vols., Paris 1717.
(2) P. S. Pallas : Flora Rossica 1785.
(3) L. B. F. Bieberstein : Flora Taurico-Caucasica Vol. II 1808.
(4) E.-A. Carrière, Traité Général des Conifères, 244 (1855).
(5) R. Pilger : Engler and Prantl, Pflanzenfamilien. 13 Band, Gymnospermae. Leipzig 1926.
(6) P. de Tchihatcheff : Asie Mineure, Paris, 1860.
(7) E. Boissier : Flora Orientalis, Vol. V, 1882.
(8) Beissner-Fitschen : Nadelholzkunde, Berlin 1930.
(9) P. den Ouden : Coniferen, Ephedra, Ginkgo, 1949.
(10) H. Czeczott : The distribution of some species in Northern Asia Minor and the problem of Pontide ; Mitteil. Konigl. Naturwis. Inst. Sofia, X, 1937, p. 43–68.

misstatements have been due to two things : the study of Turkish flora has not yet been completed and though many writers have visited some parts of the area, no one decided to study the complete distribution of this species in the country itself. Nobody has been required to prove whether *P. orientalis* really occurs in South and West Turkey, as recorded by Tchihatcheff and Boissier. Only one part of the area, namely the Caucasus, has been intensively studied by Radde (1). The Turkish part was not taken in hand until recent years. Naturally, such study and investigation requires time and effort, particularly as the great bulk of it must be done in a wild area of mountainous character. Our first journey (1945) in North-East Anatolia for this purpose took place during three summer months. Even at this season it was impossible to travel on horseback except on a few occasions and then only for short distances ; our camp beds and all our food, etc., had to be carried on the backs of the native people. Heavy rainfall and dense fogs which occur frequently render progress even more difficult. For these reasons our work in this area continued three summer seasons. After that we decided that it was necessary to investigate and prove whether this tree really grows in West and South Anatolia as Tchihatcheff and many other writers had recorded.

For this purpose we went to South Anatolia, especially the Amanus Mountains, where elements of Pontus-Caucasus flora had been earlier reported. In addition, as late as 1951, Huber-Morath (2) had reported its occurrence in these mountains ; our investigations in this area extended over three seasons ; (1951, 52, 53) then we visited South and West Anatolia several times for the same purpose. In none of these areas of the country did we see this species of tree, either as a wood, or as a stand or even in a cluster or as a single tree. On the other hand we met in South Asia Minor as native conifers : *Abies cilicica* Carr., *Cedrus libani* Laws., *Pinus nigra* Arnold var. *pallasiana* Antoine, *P. brutia* Ten., *P. halepensis* Mill., *P. pinea* L., *Taxus baccata* L., *Cupressus sempervirens* L., and several species of juniper. In West Anatolia are found : *Abies Bornmülleriana* Mattf., *A. equi-trojani* Mattf., *Pinus nigra* Arnold var. *pallasiana* Antoine, *P. silvestris* L., *P. brutia* Ten., *P. pinea* L. and some juniper species.

In contrast to the records already mentioned there are some others which limit *P. orientalis* to a smaller area than it does, in fact, occupy, and the Western end of its range has been limited to Trabzon (3) or Giresun (4).

As we have mentioned above, we see some members of Pontus-Caucasus flora in South and West Turkey, namely plants such as *Fagus orientalis* and *Rhododendron ponticum*. Conversely, we meet many typical species of the Mediterranean flora in the North. We believe that the reasons for this must be looked for in the past rather than in the ecological conditions

(1) G. Radde : "Grundzüge der Pflantzenverbreitung in den Kaukasusländern", Leipzig 1899.

(2) A. Huber-Morath : Excursion in Anatolia for collecting plants ; Importance of this plant collection to plant Geography. Biologi, Cilt : I ; Sayi : 3 ; Ocak 1951 Istanbul.

(3) K. Krause : Ueber die vegetation verhältnisse der Nordlichen Kleinasiens. Engler Bot. Jahrbuch 65, 1932–33.

(4) R. Bernhard : Waldverhältnisse der Turkei in Tharandt. Forstl. Jahrbuch 1931.

or the climatical conditions of the present. It is most likely that the East in the past did not have its present arid character and that during former glacial epochs humid and arid periods alternated. It may be assumed that contemporaneous with the humid periods elements of the Pontus-Caucasus flora spread to the South and West and, vice-versa, elements of the Mediterranean flora spread to the North, but afterwards, during the dry periods which led to the spread of the steppic flora into the heart of Asia Minor from the East, these two plant worlds became separate from each other. Therefore today one can see some isolated islands of both floras in Anatolia.

It may be that *Picea orientalis* also spread to the South or West during this humid period, but there is not any evidence available to show that oriental spruce was at any time a natural immigrant like *Fagus orientalis* to South or to West Asia Minor. We believe that the problem of its past and present distribution will be solved only by pollen analysis of deposits in different regions of the country.

Distribution of Picea orientalis

Oriental spruce is distributed throughout the greater part of the Caucasus and North-East Anatolia. The whole area of its present distribution has a North to South extension from 43°. 50′ N. to 40°. 23′N., and East to West extensions from 44°. 13′ E. (Greenwich) to 37°. 47′E. ; this area is horseshoe-shaped in outline and is of a mountainous nature. The high mountain chains have a great modifying influence on the climate and on the vegetation throughout the whole area. According to Radde the northern limit of distribution of *P. orientalis* begins East of Glowinsk and follows 450 km. South Eastwards to the line of partition

of the big Caucasus Mountains, then turns South and forms a big curve which passes between Gorgi and Tiflis, after that it reaches the small Caucasus Mountains. Its further spread to the South-East is prevented by the arid climate of the hinterland, and its area of distribution turns up towards the small Caucasus Mountains in a South-Westerly direction, where it reaches the Pontus range in North-East Anatolia. Finally, it runs along the main watershed westwards some 550 km. as far as the Melet River (see map). The distribution of our species is limited partly by the Black Sea and more particularly by mountain chains, except in the West near the Melet River. *P. orientalis* is limited W. of the Melet River by a very potent biological factor, namely by dense primitive beech forest. As the Pontus mountains lose their height from East to West optimum conditions are provided for *Fagus orientalis*, and the landscape is dominated by pure communities or, occasionally, by mixed woods of this species. In this area we have observed that where the primitive dense beech has been destroyed the space was occupied by a young generation of oriental spruce.

Ecological Conditions of the Area

(a) *Climate*. The geographical position and the high mountain ranges, particularly the Caucasus Mountains, which separate this area from the hinterland like a wall, protect it from the bitter North-East winds which have their origin in the great high-pressure system of Central Asia. All these conditions together provide and make for a humid climate. This applies to all areas characterized by an or nearly even seasonal distribution of rainfall. The rains usually come from the Black Sea. In some districts a total annual rainfall of 2,460 mm. is reached. This heavy rainfall is well distributed throughout the year (see Table). The maximum rain generally comes in the month of November, and the minimum in May. At high altitudes (*ca.* 1,200 m., where *P. orientalis* dominates, the winters are severe and there are heavy snowfalls during this season. A thick snowsheet covers all the mountains and remains on their summits for nearly the whole year. On the other hand, valleys and low parts have a mild climate. According to rain and temperature conditions, annual and the mean monthly relative humidity is rather high. Another noticeable feature in our area, particularly the upper regions, is that it is very often foggy and the sum total of cloudy days is rather high ; an average of some 160 days each year.

The temperature conditions are obviously influenced by altitude ; in the low zones the mean annual temperature is 14·5° C. The mean monthly temperatures indicate a mild climate, ranging from 5·9° C. in January to 25·9° in August. The absolute extremes of temperature recorded are 38·2° C. in August and — 6·2° C. in February. Naturally the character of this climate changes in relation to altitude, but its humid character is, except in a few localities everywhere unvaried.

(b) *Geology*. The geological history of the whole area is not old. The greater part of the mountainous area belongs to young fold mountains. Therefore Mezozoic and Tertiary rocks are largely involved though these have extensive cores of metamorphic and sedimentary rocks. In North-East Asia Minor and the Caucasus, younger volcanic rocks also cover

large areas. Only a small area of plain in the Caucasus is covered by Quaternary deposits.

(c) *Soil.* It is difficult to give a satisfactory summary of our knowledge about the soil conditions in the whole area, for, as far as we know, the subject has not been investigated, but generally speaking we found our tree, *P. orientalis*, growing on the different types of brown forest soil (loam). However, there was no obvious connection between its distribution and the petrographic constitution of the massif.

(d) *The Woodland Vegetation of the Area and the Position of P. orientalis in the Woodland Communities.* Under the climatic and edaphic conditions above mentioned, the area has developed a rich characteristic Pontus-Caucasus flora. The outstanding features of this flora were known in ancient times and, floristically, the area has always been of considerable interest to botanists. At the present time we see from the sea-shore to the uppermost plant limits in the high mountains, several types of plant communities. But of these, woodland is the dominant association. Although it has been continually deforestated for agriculture and for other purposes, the greatest part of our area is still occupied by different kinds of woodland association, and the whole area was originally covered with typical forest land. Even today, in many districts, woods still begin from coast or sea-level and are widespread to high altitudes (1800–2400 m.), where the limit of their natural distribution is reached. The woodland vegetations of the area can be roughly divided into three main vertical zones.

(A) *The Zone of Brushwood Communities.* These extend from sea-level to 600–700 m.

(B) *Deciduous Broad-leaved Forest Zone* from 600–700 m. to 1000–1200 m.

(C) *Coniferous Forest Zone* from 1000–1200 m. to 1800 -2400 m.

A. Brushwood Communities consist of shrubs or small trees. They are very extensively developed in the low regions of the country. The present distribution of these communities is strongly influenced by the activities of man. It is most likely that a great portion of it was originally forest land of high trees, but, as in the Balkan Peninsula (1) or in the Mediterranean, the trees have been extensively cut or destroyed, and replaced by the existing scrub. The floristic composition and character of the brushwood varies in different parts of the country, and three main types of brushwood have been distinguished, namely Macchie, pseudo-Macchie and Shiblyak. Unlike the Mediterranean, Macchie occurs to a comparatively small extent in our area, but members of Macchie communities are very often mixed with other communities, and the three communities mentioned above are not everywhere separable from each other. Typical Macchie, we found, is limited almost entirely to the lowlands. We met it near Trabzon and in the middle course of the river Çoruh. The chief elements of this Macchie were : *Arbutus andrachne* L., *A. unedo* L., *Rhus coriaria* L., *Juniperus oxycedrus* L., *Spartium junceum* L., *Paliurus Spina-Christi* Mill., *Pistacia palaestina* Boiss., *Myrtus communis* L., *Erica arborea* L., *Cistus villosus* L. var. *tauricus* (Presl) Grosser.

(1) W. B. Turrill : The plant-life of the Balkan Peninsula, Oxford 1929.

METEOROLOGICAL DATA

METEOROLOGICAL STATIONS			MEAN MONTHLY AND ANNUAL TEMPERATURES (CENTIGRADE)												ABSOLUTE EXTREMES OF TEMPERATURES	
No.	NAME	ALTI-TUDE METERS	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	ANN-UAL	MAXI-MUM	MINI-MUM
1	Rize	65	7·0	6·9	8·0	11·4	15·8	19·5	22·2	22·6	19·8	17·2	12·9	9·2	14·7	35·6 Aug.	−6·2 Feb.
2	Trabzon	108	7·0	6·7	7·5	11·2	15·6	19·7	22·6	23·2	20·0	17·3	12·9	8·8	14·7	38·2 Aug.	−6·2 Jan.
3	Girezon	21	6·7	6·6	7·5	10·9	15·6	20·0	22·8	23·4	20·0	17·3	12·9	8·7	14·5	34·6 May	−6·2 Feb.
4	Batum*	3	5·9	6·7	8·7	11·9	17·1	20·9	24·0	25·9	20·9	17·2	12·6	9·9	15·0		
5	Poti*	8	4·9...	6·3	9·2	12·7	17·4	20·7	23·6	23·6	20·9	17·1	12·3	8·8	14·7		

* From RADDE

No.	MEAN ANNUAL AND MONTHLY RAINFALL (MILLIMETRES) AND RELATIVE HUMIDITY PER CENT													THE NUMBER OF	
	Annual	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	CLOUDY DAYS	RAINY DAYS
	mm. %	mm. %	mm. %	mm. %	mm. %	mm. %	mm. %	mm. %	% mm.	% mm.	% mm.	% mm.	% mm.		
1	77 2493·1	70 246·7	73 218·6	72 186·7	76 98·5	80 95·3	78 146·4	80 169·4	82 241·7	81 284·5	77 224·8	77 313·2	72 267·3	164	169
2	75 979·7	72 84·5	76 74·0	75 68·4	77 64·4	80 42·8	78 51·1	77 50·3	76 51·3	75 76·4	67 102·6	74 121·7	72 87·2	160	125
3	78 1402·6	76 131·6	77 112·9	77 108·6	73 81·8	81 51·0	79 76·0	78 96·8	80 146·8	79 147·7	79 123·7	80 183·1	76 135·4	164	157
4	2356·6	260·2	173·8	166·3	124·9	71·5	158·0	136·1	221·3	288·2	253·9	292·2	240·2		
5	1555·1	129·5	93·1	85·4	75·4	55·6	142·3	148·6	247·4	196·6	143·9	134·1	133·0		

Pseudo Macchie, related floristically to the true Macchie formation, extends over considerable areas and to high altitudes in the low zone. Its important members are : *Prunus laurocerasus* L., *Rhododendron ponticum* L., *Rh. flavum* L., *Ilex aquifolium* L., *Buxus sempervirens* L., *Ligustrum vulgare* L., *Euonymus europaeus* L., *E. latifolia* Scop., *Staphylaea pinnata* L., *Laurus nobilis* L., *Corylus maxima* Mill., *Cornus sanguinea* L., *C. mas* L., *Daphne pontica* L., *Hedera helix* L., *H. colchica* C. Koch, *Smilax excelsa* L., *Clematis vitalba* L. etc.

Shiblyak. This community is, in fact, a remainder of earlier forest vegetation, and several different types of it are developed in different districts of the region. The chief woody elements of Shiblyak are : *Acer campestre* Scop., *Castanea sativa* Mill., *Carpinus betulus* L., *Tilia tomentosa* Moench., *Cornus mas* L., *C. sanguinea* L., *Rhododendron ponticum* L., *Rh. flavum* L., *Hedera helix* L., *Smilax excelsa* L., etc. *Picea orientalis* and other conifers such as yew, juniper, scots pine and stone pine rarely form widespread stands in the brushwood communities but occur here and there in small patches mixed with the other characteristic elements of the communities.

B. Broad-leaved Forest. The woodland formation of the second zone can be subdivided into two main groups, namely : mixed mesophilous woods ; and beech woods, either pure or mixed with deciduous species or conifers.

(i) *Mixed Woods* occupy the low parts of the zone and consist of the following trees and shrubs : *Alnus barbata* C. A. Mey., *Castanea sativa* Mill., *Quercus pedunculata* Ehrh., *Q. armeniaca* Kotschy, *Q. pontica* C. Koch, *Ulmus glabra* Huds., *Tilia tomentosa* Moench, *Acer campestre* L., *Fagus orientalis* Lipsky, *Populus tremula* L., *Fraxinus oxycarpa* Willd.

Very often these trees and shrubs grow together, forming a mixed forest, but in some localities, under special local conditions they make pure stands of oak, chestnut, aspen or alder. The mixed forests have a rich undergrowth of shrubs composed of *Rhododendron ponticum* L., *Rh. flavum* L., *Ilex aquifolium* L., *Sambucus nigra* L., *Vaccinium arctostaphylos* L., *V. myrtillus* L., *Rhododendron caucasicum* Pall., *Lonicera orientalis* Lam., *Daphne pontica* L.

(ii) *Beech Forest* is characteristic of the upper part of the zone. The dominant species (*Fagus orientalis*) forms pure stands in several districts but broad-leaved deciduous species and conifers are often mixed, and in addition to the *Fagus*, such woodland may contain *Carpinus betulus* L., *Acer trautvetteri* Medw., *Picea orientalis* Carr., *Abies nordmanniana* (Link) Spach and *Taxus baccata* L. Under dense beech forest the ground flora is usually poor, but where it is more open *Rhododendron ponticum*, *Rh. flavum*, *Vaccinium arctostaphylos*, *Viburnum orientale*, etc., are found.

C. Conifer Forest. At the present time a belt of conifer forest occurs above the beech zone on the high mountains at altitudes ranging from 1100–1200 m. up to 1800–2400 m. The conifer communities cover extensive areas, but there is not always a sharp line of demarcation between the conifer and beech zones, very often the conifer and beech communities merge together and both reach, on some slopes, to the wood

and tree limit. The conifer forest is usually formed by *Picea orientalis*, *Abies nordmanniana* and *Pinus silvestris*. *Picea orientalis* is not limited to this zone, but over the whole area, it is the most important and characteristic constituent of high altitude conifer forest. In Turkey alone, it forms some 200,000 h. of pure or mixed natural forest. At high altitudes it sometimes forms pure stands over considerable areas ; on the other hand it is often accompanied by beech (*Fagus orientalis*), fir (*Abies nordmanniana*), pine (*Pinus silvestris*), though, except in some local places, oriental spruce is a dominant partner everywhere in this zone. Where it finds optimum conditions for its growth, many full grown trees will reach a height of 30–40 m. and 70–80 cm. diameter. In the Murvan valley, we found a very old stand, containing many gigantic and fine examples 50 m. high and 175 cm. diameter. In the same area we saw, here and there, magnificent primitive mixed woods which were, from a silvicultural point of view, models of their kind. The highest limit of conifer forest was in North-East Turkey, at 2400 m. in the Yalniz Çam Mountains, but, a significant factor in the distribution of *Picea orientalis*, is, that at no point, does it pass over the mountains to reach the inland exposed slopes.

Abies nordmanniana forms pure stands only locally at the present time. It is usually mixed with the Beech or Spruce woods. It plays a secondary role in the conifer forest of this area.

Pinus silvestris is not as widespread as *A. nordmanniana* in the area, although it is an important tree in other areas of Turkey.

The ground flora in the conifer woods is usually poor and consists largely of mosses, lichens and liverworts. But where there is sufficient light and space, the ground is occupied by *Rhododendron* and *Vaccinium*. There are nowadays clearings among woods in this zone, such clearings are also covered by *Rhododendron* and *Vaccinium*. It is noticeable that *Rhododendron*, a common associate of *Picea orientalis*, very often forms a low shrub belt above the limit of high mountain forest. It is most likely that many parts of this belt were formerly covered by trees, with Rhododendrons forming the ground flora ; unfortunately the high mountain forests are being continually destroyed for pasture.

Summary

Picea orientalis is one of the valuable forest trees of the Caucasus and Turkey ; it is also an effective ornamental tree in the parks and gardens of many countries. This tree is indigenous only in the Caucasus and North-Eastern Anatolia. Our study and investigation have shown us that it does not exist in the South nor in the West of Asia Minor, and we have come to the conclusion that the records of Tchihatcheff, Boissier, Pilger and many other writers about its existence in these areas were erroneous. In fact, we now know from our own observation that its distribution does not extend further west than the Melet River ; namely to the middle and West part of Northern Anatolia. Oriental spruce shows no preferences for any particular soil types ; it ranges from the sea shore to 1800–2400 m. in many districts but reaches its optimum development above 1200 m. The rarity of *Picea orientalis* in the lowlands of the area may be more connected with the influence of some biotic factors (human interference ; competition with other species, etc.) than with

climatic and edaphic factors. On the other hand its general distribution is determined mainly by climatic factors. Where the climate is markedly dry, *Picea orientalis* diminishes. Its growth is restricted by deficient rainfall and low atmospheric humidity. Its distribution westwards is also limited by the occurrence of *Fagus orientalis*, which reaches its optimum development west of the area where *P. orientalis* is found.

Asiatic Magnolias.*—The genus *Magnolia* is of considerable horticultural importance in that many of its species can be grown in British gardens, though best in the south-west, and produce large and beautiful flowers. Botanically there are numerous special interests associated with the gross morphology, anatomy, phytogeography, and history of members of the group, including allied, or supposedly allied, genera. The book here under notice by Mr. George Johnstone, published by the Royal Horticultural Society, is not a monograph of the genus as a whole but is essentially an account of the Asiatic species grown and studied as living plants by the author. Eighteen species, classified into seven sections are thus considered. This is not to suggest that the taxonomy has been in any way neglected. Keys to the sections and species are provided and lists of synonyms and published illustrations are given. Nevertheless, the special value of this book lies in the first-hand accounts of the characters of the plants with which the author has lived for many years. To study the growing plants through all seasons year after year has given him an insight into their structure and behaviour which could not otherwise be attained. Cultivators and botanists must be indebted to Mr. Johnstone for recording so lucidly and attractively his observations and conclusions.

The fourteen coloured plates are well reproduced. The majority of these are from originals by Miss A. V. Webster, with two by Miss S. Ross-Craig, and one by P. Ciccimara. The drawings and reproductions of photographs also add to the charm and usefulness of the work. A bibliography, a glossary, and an index are provided. The President of the Royal Horticultural Society, the Hon. D. Bowes-Lyon, V.M.H., commends the book in an appreciative Foreword.

The format of this work is on the whole pleasing though the top margin seems unduly narrow and the fount for the specific, subspecific, and varietal headings unduly large. Proof-reading has been carefully done though the chromosome number for *Magnolia denudata* as given on p. 45, should surely be 114 and not 411. Spaces for M.S. notes constitute an unusual feature.

Both the author and the Royal Horticultural Society are to be congratulated on the production of " Asiatic Magnolias in Cultivation ".

W. B. TURRILL.

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* Asiatic Magnolias in Cultivation, by G. H. Johnstone, O.B.E., V.M.H. The Royal Horticultural Society, Vincent Square, London, S.W.1., 1955, pp. 160. £3-3-0.

VERONICA DELTIGERA Wallich ex Benth.

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Bentham, in his monograph " Scrophularineae Indicae " (1835, p. 45), gave, under species number 5 of the genus *Veronica*, a perfectly adequate description of this species ; his description was disregarded by later authors.

The original description of Bentham is : " 5. *V. deltigera* Wall. Cat. 402, basi procumbens, caule glabro sub foliis bifariam lanato, foliis sessilibus ovato-lanceolatis crenato-serratis glabris, racemis alternis paucis pubescentibus, calycibus 4-partitis, capsulis (inmaturis) rhombeo-dilatatis emarginatis.—Hab. ad Gossain Than Emodi [Eastern Himalaya], *Wallich* ". Later, in De Candolle's Prodromus (**10,** 475, no. 76), he added some other characters : " caule procumbente . . ., foliis leviter serrato-crenatis . . . ., racemis elongatis . . ., capsula plano-compressa subrhombea transverse latiore. . . . glabra ciliata. Folia basi rotundata. Racemi *V. canae* vel longiores. Capsulas maturas ipse non vidi, ex schedis Wallichianis descripsi. Caetera V. Chamaedryos (v.s.) ".

The above descriptions agree perfectly with the typical specimens, as may be seen in my drawings of Wallich's type (in Bentham's Herb.).

Bentham described, as number 7, another species from the Western Himalaya on the same page of his 1835 work : " 7. *V. lanosa* Royle (Mss., sec. Bentham), caule basi lignoso, ramis caespitosis suberectis lanatis, foliis sessilibus ovato-lanceolatis inciso-serratis supra glabris subtus piloso-hirtis, racemis laxiusculis, calycibus inaequaliter 4–5-partitis, capsulis (inmaturis) ovatis acutis.—Hab. in Kanaour, *Royle* ". In the " Prodromus " (p. 481, no. 110) Bentham completed the description, making himself the author of the species, and referring in the first place to the specimens of Edgeworth (*). The most important characters added are the following : " hirsuta, caulibus e basi ramosa erectis vel adscendentibus subsimplicibus, foliis subsessilibus. . . . acutis argute serratis, ... pedicellis calyce puberulo 2–3-plo longioribus. . . . In jugi Himalayae variis locis (Edgeworth !) . . . Caulis molliter villosus. (v.s.) ".

It may be inferred from the descriptions that the two plants belong to different sections of the genus (*Chamaedrys* and *Veronicastrum*), so that it is not easy to understand the confusion of Hooker (1884, p. 292) who united them in a single species, and whose " hybrid description " I transcribe partially, with indication of the characters which belong to each species : " *V. deltigera* Wall. in Benth. Scroph. Ind. 45, and Cat. 402 ; stems many from the root erect or ascending pubescent (*V. lanosa*) often bifariously (*V. deltigera*). . . ., sepals 4 linear-oblong subacute (*V lanosa*), capsule oblong-ovoid (*V. lanosa*). . . . Western alpine Himalaya ; from Kashmir (*V. lanosa*) to Nepal (*V. deltigera*). Perennial

(*) This change may be due to the omission of this plant in the manuscript of Royle, preserved in the Library of the Kew Herbarium, or perhaps to the better condition of the Edgeworth specimens. The type of *V. lanosa* consists of two specimens in Bentham's Herbarium in the Kew Herbarium : these were taken from the more extensive material in Royle's Herbarium, which is now preserved at the City of Liverpool Public Museums.

FIG. 1.

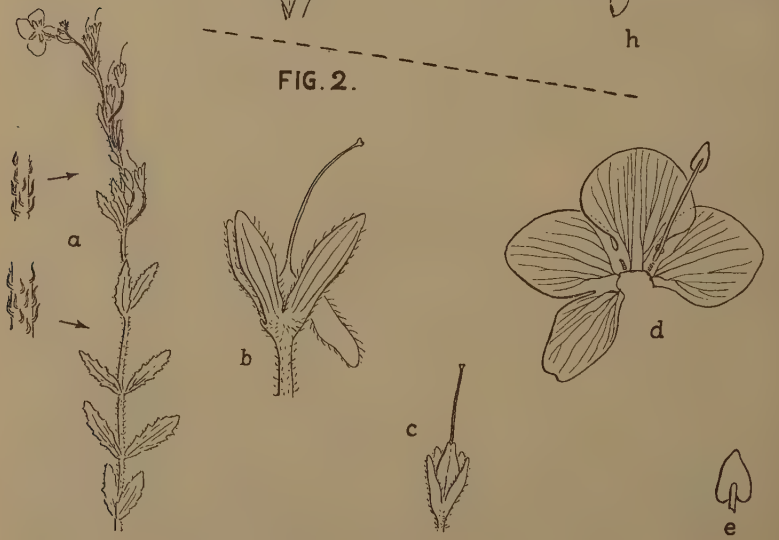

FIG. 2.

rootstock short, woody (*V. lanosa*). Stems . . . rigid (*V. lanosa*) . . . Leaves . . . sometimes inciso-serrate, base rounded (*V. deltigera*) or acute (*V. lanosa*) . . . . The description of the fruit in DC. Prodr. is taken from some other plant ".(*)

The erroneous views of Hooker were accepted by the monographer Römpp (1928, p. 24) and later writers, such as the compiler Stroh (1942, p. 386, n. 6). Pennell (1943, p. 87, n. 21 ; and p. 75, n. 3), trying to distinguish both species, confounded *V. deltigera* with *V. javanica* Blume, an annual plant with petiolate leaves.

I was fortunate enough in 1954 to examine the type of Wallich in the Kew Herbarium (Bentham's and Hooker's Herbaria) and I have prepared drawings of the most interesting characters, which I publish together with figures of fruiting specimens preserved at the British Museum Herbarium. (**) My study has shown the correctness of Bentham's views and the confusion caused by later writers.

Pennell was right in placing *V. deltigera* in the section *Chamaedrys* but, being unable to study the types of Wallich, he too was unable to have an exact idea of the species, which he identified wrongly with *V. javanica*. I believe that the major affinities are with *V. cana* Wallich ex Benth., but the pilosity and the sessile leaves allow their differentiation. In the section *Chamaedrys* the same form of fruit is proper to a number of S.E. Asiatic species ; among them, *V. deltigera* is a linnaeon of the first rank. I give a brief Latin description as a complement to my drawings, and these are published since no illustration of the species has been found in the extensive bibliography consulted.

Planta perennis, caule decumbente et radicante subglabro et parce lignificato, cum stolonibus subterraneis elongatis. Parte superiore internodiis bifariam pilosa, cum pilis longis articulatis eglandulosisque ; pilositate inflorescentiae copiosa et sparsa, in parte superiore glandulosa. Foliis sessilibus, late ovato-lanceolatis glabrisque, marginibus remote et leviter crenato-serratis. Inflorescentiis longis internodia multo superantibus ; corolla quam calice duplo vel triplo longiore stylum subaequante ; basi et marginibus sepalorum cum pilis sparsis articulatis glandulosisque ; capsula glabriuscula subtriangulato-rhomboidea, later-

(*) This affirmation is unsound as may be seen from my drawings of the type, with a young fruit made visible by Bentham, as he cut away the two sepals that covered it.

(**) I have studied the following material of *V. deltigera* Wallich : Kew Herbarium :— Gossain Than Emodi, *Wallich* 1832, n. 402 (Hb. Benth.) ; Gossain Than Emodi, *Wallich*, herb. 1824 (Hb. Hook.) [There is also a sheet of this collection in the Wallich Herbarium at Kew.—Ed.]. British Museum Herbarium :—Dorpu, 7–8,000 ft., *Capt. Lall Dhwoj*, 1930, n. 59 (two sheets), cf. Fig. 1, d–h ; Rimoo, 10–11000 ft., *Capt. Lall Dhwoj*, 1930, n. 123.

Fig. 1. *Veronica deltigera* Wallich ex Benth. a, entire plant, × ½ ; b, young fruit, × 3 ; c, the same, × 5 ; d, opened corolla with nervation, × 2⅔ ; e, the corresponding calyx of the preceding, × 4 ; f, mature fruit with its bract and glandular pilosity, × 3 ; g, opened fruit, × 3 ; h, seeds, 1 × 14, 2 × 15, 3 × 11. a–c, Gossain Than Emodi, *Wallich* 402, Herb. Benth. (Herb. Kew.) ; d–h, Dorpu, *Capt. Lall Dhwoj* 59 (Herb. Mus. Brit.).

Fig. 2. *Veronica lanosa* Royle ex Benth. a, top of plant, × ½ ; b, flower after removal of corolla, four sepals and another rudimentary one, × 5½ ; c, fruit, × 1½ ; d, corolla corresponding to flower of b, × 2½ ; e, anther, × 4. a, b, d, e, Chitral, Madaslast, 10,000 ft., July 1908, *Major S. M. Toppin* 536 (Herb. Kew.); c, Gilgit, 1909, *Major S. M. Toppin* 1004 (Herb. Kew.).

ibus concavis et apice emarginato cum pilis sparsis articulatis glandulosisque. Hab. : Nepal, in montibus orientalibus Himalayae.

I have had the opportunity of going through the sheets of the Herbarium of the Muséum du Jardin des Plantes of Paris : there I saw only *V. lanosa*, often labelled as *V. deltigera*.

I hope that I have contributed to the clarification of this taxonomic problem and trust that this paper may be of use to students of the Asiatic flora and to those interested in inter-specific affinities in the genus *Veronica*.

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Vanilla.*—Although the orchids may be considered as paramount among plants from an horticultural point of view, it is interesting to note that they include very few plants of economic importance in other fields. Of these the genus *Vanilla* is pre-eminent. In spite of the large scale manufacture of synthetic vanillin, there is still a considerable demand for the natural product, and the cultivation and exploitation of the vanilla plant is an important industry in various parts of the Tropics.

Though much has been written about *Vanilla*, never before has all the available information been brought together as in the book here noticed. Dr. Bouriquet has not only made valuable contributions to the book himself, but has had the help of specialists who have dealt with many

* Le Vanillier et la Vanille dans le Monde. By G. Bouriquet. Pp. xi + 748, 4 coloured plates, 16 monochrome plates, 224 text figs. and 14 maps. Paul Lechevalier, Paris, 1954. Price 15,000 francs.

aspects of the subject, botanical, agricultural, chemical and economic. Together these collaborators have produced a valuable book which will no doubt remain the standard reference text for many years.

Following introductory chapters dealing with the cytology and anatomy of the genus we find the longest section in the book, over 200 pages, in which Professor Portères gives an account of the classification and distribution of the whole genus. This is the first complete account since Rolfe's revision, published so long ago as 1896 ; the fact that Rolfe enumerates 52 species whereas in the present account 110 are recognised indicates the advance in our knowledge of the genus during the past 60 years. Prof. Portères supplies reasonably complete and comparable descriptions of all the species, many of which are illustrated by excellent line drawings. There are also maps showing the distribution of the various groups recognised. A key for the determination of the species is provided, no mean feat in view of the size of the genus and the frequent difficulty of expressing clearly the subtle differences between allied species.

One would wish, however, that the author had dealt with the classification on more fundamental lines. He maintains Rolfe's primary separation into leafy and leafless species, which is certainly an easy division in practice, but is doubtfully sound taxonomically, separating as it does species with remarkably similar floral structure. In his introductory comments Prof. Portères clearly recognises this (see p. 116) and it seems a pity that he did not follow up in his classification the logical views he expresses.

The division into groups according to the nature of the outgrowths on the labellum seems sound, but it is necessary to obtain a very clear idea of what should be included in the two types. The scales so characteristic of subsect. *Lamellosae* can in some species be so finely divided that they resemble hairs and these species may easily be placed in the wrong division of the genus. Certain points seem to call for comment. *V. tisserantii*, a species recently described by Prof. Portères, although placed in the subsection *Papillosae*, is evidently a member of subsect. *Lamellosae*, as the drawings in fig. 83 clearly show. Nor can the reviewer agree with Prof. Portères' varieties of *V. africana* Lindl. on p. 205, which all appear to be referable to *V. ramosa* Rolfe, as also is fig. 95. It would seem that the author has not been able to examine some of the species as thoroughly as is desirable for the production of a revision of this nature. Nevertheless the bringing together of descriptions of, and references to the literature dealing with, all the species of the genus is of great value to other workers in the group.

Dr. Stehlé contributes an important section on the ecology of the cultivated species in their native haunts, showing the fundamental relationship between this and proper conditions for cultivation. The various areas in which *Vanilla* is cultivated are discussed in relation to the basic ecological data. Dr. Bouriquet follows with sections dealing with the germination of the seeds and the cultivation of the vines themselves. This latter section gives a clear and complete account of cultivation methods and procedures. Other chapters are on fungal and animal pests, the drying and conditioning of gathered fruits and the chemistry of the vanilla essence.

There is a very complete series of references to the previous literature on the subject, both at the end of each chapter or section and in the form of additional references at the end. Over 200 illustrations, some of which unfortunately are not very clear, add to the value of the text. The general format is pleasing and makes the book easy to read. Altogether this is a book which will be needed by all interested in the subject of *Vanilla*.

V. S. SUMMERHAYES.

North American Trees and Shrubs.*—This book may be recommended to those British botanists (and how many there are) who pay little attention to their native and cultivated trees. It is a revision and enlargement of an earlier work, " Trees and Shrubs of Minnesota " (1928), which was itself an elaboration of " Minnesota Trees and Shrubs " (1912). The final author, then, who has gradually divested himself of his collaborators, may reasonably be expected to have given a good account of the woody plants of an area which includes the States of Minnesota, Wisconsin, northern Iowa, and North and South Dakota east of the Missouri River. Once again the European reader is cheated of the map which he so rightly demands in such a book, finding only (on p. 13) a small sketch, devoid of place-names, of the three main vegetation regions of grassland, deciduous forest and northern coniferous forest.

A valuable key to the genera of all the families uses characters taken entirely from wood, twigs and leaves. The careful descriptions are illustrated by many drawings and photographs, and the outlines of leaves of species of many critical genera such as *Rubus*, *Amelanchier*, *Cornus*, *Populus* and *Salix*, will be particularly helpful. Many of the trees and shrubs included in this work are known to us here, if only in gardens, but the common names—which have precedence over the Latin ones—will sometimes be unfamiliar. There are one or two surprises : the Horse Chestnut is said to have been " introduced from Asia via Europe " ; and the name *Populus candicans* Ait. is retained for the Balm of Gilead, without mention of *P.* × *gileadensis* Rouleau (in strange contrast, in our own new British Flora, *P. balsamifera* appears in the Index, on p. 1571, as a synonym with reference to p. 743, where there is, however, no mention of that name as belonging to an ally or parent of *P. gileadensis*). The characters and descriptions given for distinguishing *Lycium halimifolium* and *L. chinense* (here called " Matrimony Vines ") bear a striking resemblance to those found in " Clapham, Tutin and Warburg ", and one wonders if American readers will have any better success with them.

N. Y. SANDWITH.

* Trees and Shrubs of the Upper Midwest. By Carl Otto Rosendahl. 1955. Pp. 411. Minneapolis : University of Minnesota Press. Price $6.00; 48/- net.